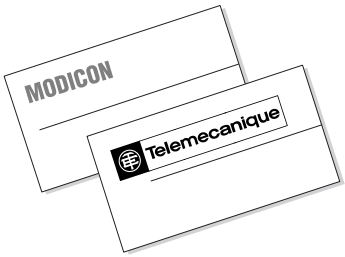
OPC Factory Server

OLE for Process Control

User's Manual



GROUPE SCHNEIDER

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OPC Factory Server

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1.1 Introduction

OFS (***OPC F***actory ***S***erver) is a **multi-PLC** data server able to communicate with real-time I/O devices in the TSX Compact, TSX Micro, TSX Momentum, TSX/PCX/PMX Premium and TSX Quantum families, and serve data to OPC clients.

This means that it provides a group of **services** (primitives) to client applications for access to control system variables.

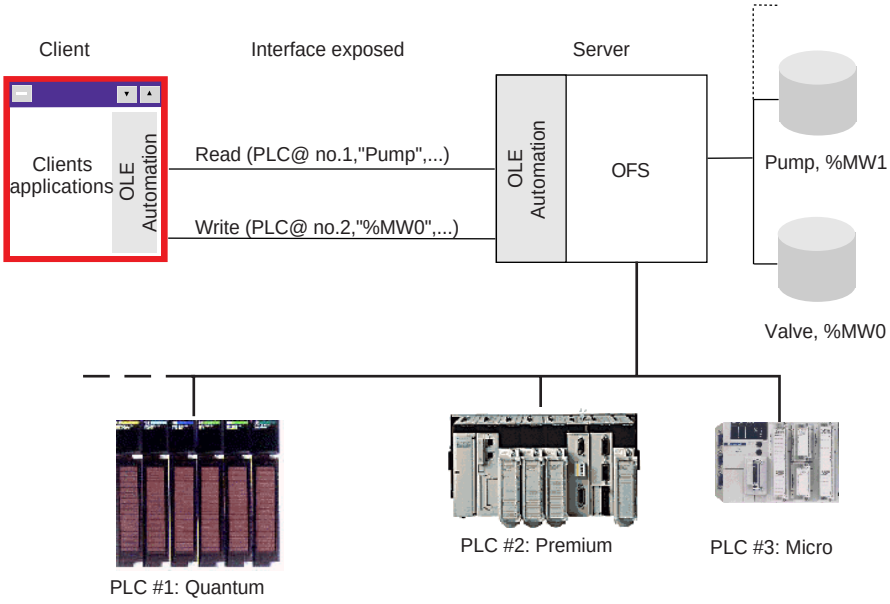
OFS is OPC (Version 1.01a) compliant, i.e. it will function with any OPC (Version 1.01a) compliant client and with two types of OPC compliant software :

- Ready-to run supervisory software from any vendor (in this case, the OFS will act as a driver, providing connection to any Schneider Automation supported PLCs),
- Custom developed supervisory software using either the OLE automation or OLE custom interface.

Note:

Knowledge of one of the following languages is required when creating a client application for the OFS, in particular for OLE Automation, OLE Custom programming and exception management :

- Microsoft Visual Basic, version 5.0 or later, SP3,
- Microsoft Visual C++, version 5.0 or later,
- Microsoft VBA in Excel, version 8.0 (Office 97) or later.



The OFS server provides the interface between a group of PLCs and one or more client applications in which the values of some of the data of these PLCs are to be viewed and/or modified.

The main characteristics are :

- Multi-PLC,
- Multiple communication protocols,
- Multi-client,
- Access to variables via address or symbol,
- Local or remote access to server,
- Exposes its services via both the OLE Automation and OLE Custom interfaces,
- Compatible with the OPC standard Version 1.01a.

1.2 PLC Compatibility

The OFS server operates with the Schneider Automation TSX Micro and TSX/PCX/PMX Premium PLC ranges (**UNI-TE V2** communication protocol) as well as the TSX Quantum, TSX Momentum and TSX Compact ranges (**Modbus** protocol).

The OFS server is not compatible with Series 7, Series 1000 Schneider Automation PLC ranges or A-linie (AEG).

1.3 Communication Media Supported

The OFS server is compatible with the following media :

- **UNI-TE V2** Prototcol :
  - UNITELWAY,
  - FIPWAY,
  - ISAWAY,
  - ETHWAY,
  - XIPWAY.
- **Modbus** Protocol:
  - Modbus+,
  - Modbus TCP/IP.

2.1 Contents of the Product

The OFS product comprises :

- One CD-ROM with setup instructions,
- Product Code ID.

Depending on your Product Code ID, the CD ROM may give you access to :

- The OFS server,
- The OFS simulator,
- The OFS Configuration Tool,
- XWAY Drivers,
- Documentation,
- Sample of Symbol Tables,
- OPC Clients :
  - Tutorial Client in Visual Basic (including source code),
  - Tutorial Client in C ++ (including source code),
  - Test Client in Visual Basic (not supported*),
  - Test Client in C ++ (not supported*),
  - Test Client in HTML (not supported*),
  - Test Client in Excel (not supported*).

Note :

The OFS product does not contain any cable for communication between the PC and the PLC.

Note (*) :

The term "not supported" means that Schneider Automation does not provide any technical support for these tools and examples.

Note :

The documentation is in Acrobat Reader format (pdf file). If you don't have this tool already installed on your machine, it is given on the CD in the **Redist\Acrobat** directory.

2.2 Hardware and Software Configuration

Configuration for NT 4.0 and Windows 95 :

- Pentium 133 MHz (minimal configuration), Pentium 166 MHz (standard configuration) ,
- 32 Mb of RAM.

Recommended configuration for NT 4.0 :

- Pentium 200 MHz,
- 48 Mb of RAM for executing the client application,
- 64 Mb of RAM for developing the client application.

The OFS product requires a PC "Wintel" platform : Intel x86 processor with either of the following Microsoft Windows 32-bit operating systems :

- Windows 95 upgraded with **S**ervice **P**ack 1 (or later) *with* the **DCOM** option ,
- NT 4.0 upgraded with **S**ervice **P**ack 3 (or later).

Note :

The DCOM option is necessary under Windows 95 even for running the OFS server locally. The DCOM version required is version 1.1 (or later) and is included on the OFS installation CD-ROM. To install DCOM, follow the instructions given in the ReadMe.txt file on the installation CD-ROM in the **Redist\W95\dcom** directory.

Note :

The OFS product is not compatible with a RISC platform, in particular with NT 4.0 on a Digital Alpha processor.

To determine which version of Windows and which service pack is installed on your PC :

- **Windows 95**

  Open the Control Panel, then click on the **"System"** icon, the displayed page shows your system version :

  - 4.0.950 = no service pack installed - install service pack 1,
  - 4.0.950a = service pack 1 is installed, click on OK,
  - 4.0.950b = service pack 2 is installed, click on OK.

  To verify that DCOM is installed, Open the Control Panel, then click on the **"Add/ Remove Programs".**

  If DCOM is installed, you should find a line : " **DCOM for Windows 95** ".
  If you don't have this line and you are sure that DCOM is installed (for instance because you installed Internet Explorer 4.0) go on and ignore the installshield warning. Otherwise you should install DCOM option before installing the server.

To install DCOM, follow the instructions given in the **ReadMe.txt** file on the installation CD-ROM in the **Redist\W95\dcom** directory.

- **Windows NT**

  Open Programs\Administrative Tools\Windows NT\Diagnostics - your system version is displayed, it should be at least :

  - Version 4.0 (Build 1381: Service Pack 3).

  Under NT4.0, DCOM **is always** installed.

2.3 Installation Procedure

Foreword :

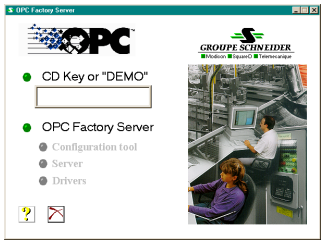
> Under NT 4.0, it is necessary to have sufficient administrator rights before executing the installation program (see Section 2.4).

The installation procedure for the OFS product is as follows :

Insert the CD-ROM in the CD drive. The CD is Auto-run, therefore if your PC is set up for this feature you should see the OFS main window as shown below. If Auto-run is disabled or doesn't work :

- Click on the **Start** button in the taskbar,
- Select **Settings -> Control Panel** then click,
- Click on the **Add/Remove Programs** icon in the Control Panel,
- Click on the **Install/Uninstall** tab then click on the **Install** button and follow the instructions,
- The Install Tool will automatically find the OFS Setup program on the CD, display the path and file name then prompt you to conclude the installation.

  The window shown below is displayed showing the OFS installation options.



The first thing to do is to enter into the dialog box either your **CD-KEY** or the word **DEMO** in uppercase (the **CD-KEY** is your product-ID, located on a piece of paper included with the CD-ROM).

The following components may be installed (depending on your CD-KEY) :

- **OFS Configuration Tool**,
- **OFS Server**,
- **XWAY Drivers :**
  - **UNITELWAY,**
  - **FIPWAY,**
  - **ISAWAY,**
  - **ETHWAY,**
  - **XWAY TCP/IP.**

Note :

The above components must be installed in the order of Configuration Tool, Server, Drivers.

1. Click on the black button labelled **Configuration tool**,

• Follow the messages which appear on the screen to perform the installation.

• At the point where the installation program prompts for a directory, the default directory is C:\Program Files\Modicon Telemecanique.

Note:

During installation of the **OFS Configuration Tool** under **Windows 95**, the following warning may be displayed :

"*Setup cannot continue because some system files are out-of-date on your system. Click on OK if you would like setup to update these files for you now. You will need to restart Windows before you can run setup again.*
Click Cancel to exit setup without updating the system files".

- Click the OK button,
- Reboot when the system prompts you to,
- Restart Windows 95 and install the OFS Configuration Tool again.

2. When installation of the Configuration Tool is complete, the installation start-up screen is once more displayed - now click on **Server**,

• Follow the messages which appear on the screen to perform the installation.

• The installation program offers the following options :

- Installation and parameter definition for the client and server stations :

- Installation (under "SERVER" directory) of the server for **local** AND **remote** operation,
- Definition of the **client** station parameters for **remote** operation with the server.

If this option is chosen, setup prompts for the name of the remote client - (\\<name of machine>). The remote client name may be entered in plain text, as a TCP/IP address (eg. 139.160.218.102) or as a Domain Name System (DNS) name.

Note :

To change from one type of installation to another, simply restart the installation program.

- Optional installation (under "TUTORIAL" directory) of the Visual Basic and C++ tutorials,

- Optional installation (under "NOTSUP" directory) of the programs which are not supported (see Section 2.1),

- Optional installation of direct link to **Concept V2.1** Programming Workshop (**Concept** is a programming tool from TSX Quantum, TSX Monentum PLC range). Setup verifies the presence of the **Concept** Programming Workshop on the machine in the indicated directory.

Note :

Since the Configuration Tool and the VB tutorial programs were written using Visual Basic V5, any version of Visual Basic subsequently installed should be V5 in order to avoid compatibility problems.

Comment :

When executing the installation program under Windows 95, messages indicating problems with version and corruption of Windows system DLL may appear (for example : COMPOBJ.DLL, DDEML.DLL).

These messages should be ignored (Windows 95 automatically corrects these problems), as they do not affect operation of the terminal.

3. To uninstall the OFS product, open "Add/Remove Programs" in the Control Panel, and delete "OFSconf V *x.y.z* IE *xx*" and "OPC Factory Server" as required.

Notes :

- In the case of an upgrade from a previous version, first uninstall the old version and then install the new one. Performing an uninstall does not affect the parameter configuration data.

- Some problems may arise if the path of the destination directory (directory where the Server and Configuration Tool are to be installed) is too long and the hard drive on your PC has been converted from FAT to NTFS. In this case, try to use short file names.

e.g. C:\OFS - instead of
C:\Program Files\Modicon Telemecanique\OFS

In particular, avoid spaces in file names.

2.4 Defining the Parameters for Local or Remote Operation

The OFS server can operate in **local** and **remote** modes.

- **Execution under Windows 95**

  Remote execution mode requires additional adjustment to be made using the DCOMCnfg.exe tool available from Microsoft.

  - Server Station :

  - Start DCOMCnfg.exe from the Windows\System directory,
  - From the list in the Application folder select **"Schneider-Aut OPC Factory Server",**
  - Click on the **"Properties"** button - the **"Properties"** Dialog Box appears,
  - In the security folder select **"Use Custom Access Permission",**
  - Click on the **"Edit"** Button - the **"Access Permissions"** Dialog Box appears,
  - Click on the **"Add"** button then add users and grant them access - then click on **"OK"** to close the Dialog Box,
  - Close the "**Properties"** Dialog Box by clicking "**OK**" button.
  - In the default security tab, check the «**Enable Remote Connections**» check box
  - Close the **«DCOMcnfg**» Dialog Box by clicking «**OK**» button.
  - Reboot the PC

  - Client Station :

  - Start DCOMCnfg.exe from the Windows\System directory,
  - From the Application folder click on the **"Default Security"** tab,
  - In the **"Default Security"** folder click on the **"Edit Default"** button then edit/add users and access rights. Close down the tool as above.

- **Execution under NT 4.0**

  Remote execution requires additional adjustment to be made using the DCOMCnfg.exe tool supplied with NT 4.0.

  These configuration settings must be made while logged on to the machine with an account having the necessary administration rights to give access and execution permission to the Server station.

  - Server Station :
    - Start DCOMCnfg.exe from the Windows\System32 directory,
    - From the list in the Application folder select **"Schneider-Aut OPC Factory Server",**

- Click on the **"Properties"** button - the **"Properties"** Dialog Box appears,
- Click on the **"Identity"** tab and select **"The Interactive User",**
- In the security folder, select **"Use Custom Access Permission",**
- Click on the **"Edit"** button, the **"Acces Permission"** dialog box appears,
- Click on the **"Add"** button, add users and grant them access,
- Click on **"OK"** to close down the dialog boxes,
- Select "**Use Custom Execute Permission",**
- Click on the **"Add"** button, add users and grant them access,
- Click **"OK"** to close down the dialog boxes.

Note :

The following parameters (default parameters) must be defined in the "Default properties" tab :

- Option : "Enable Distributed COM on this computer" checked,
- Field : "Default Authentication level" set to "Connect",
- Field : "Default Impersonation level" set to "Identify".

- Client station :

To give **access** rights to the server from the client station :
"Default security" tab, select the rights for access and execution.

- **Summary of OFS Server remote operation**

	OFS server on Windows 95	**OFS server on NT 4.0**
Client application on Windows 95	YES	YES
Client application on NT 4.0	YES	YES

Notes :

- Under Windows 95, the OFS server must be started manually before any connection attempt from a remote client.

- When the server is running under Windows 95, in case of connection problems, it may be useful to modify the check box about DCOM security in the misc tab of the configuration tool (see 3.8).

3.1 Description

The OFS Configuration Tool is an essential component of the OFS product. It enables the user to configure the OFS server and its simulator to interface with Networks, Devices and Symbol Tables.

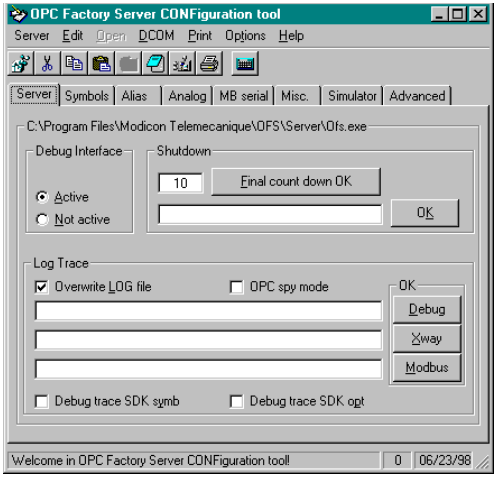
Notes :

- All modifications to the Server configuration are static - for them to take effect, the Server must be shut down and restarted.

- All modifications are made *in real-time* in the Windows registry**.** You can follow what is being modified reading the status bar. You don't need to quit the software to validate.

To run the OFS Configuration Tool, proceed as follows :

- Click on the **Start** button in the taskbar, then move the pointer to "Programs"\"Modicon Telemecanique"\"OFS Configuration Tool" and then click the left hand mouse button,
- The Configuration Tool main window opens as shown below,



The OFS Configuration Tool window comprises a Menu Bar, with a Tool Bar under, and eight Page Tabs. These are :

- Server : access to debug interface, customize shutdown procedure, define trace log,
- Symbols : define the file extension of symbol table recognized by the server,
- Alias : define alias on driver, PLC address, symbol table,
- Analog : define analog type for dead banding,
- MB serial : future extension to parameter serial ports for ModBus serial protocol,
- Misc. : miscellaneous parameters,
- *Simulator* : rule of evolution of simulated variables for the simulator OFS_simu.exe which shares all other parameters with the OFS.exe product,
- Advanced : server advanced parameters.

Each Tab accesses a page of configuration options. There is no default Tab, the active Page is the last one used. The functions of each Page are now described in Left-to-Right order.

Note :

All Icons, Buttons, Checkboxes, etc. are provided with "Tool Tips".

3.2 Server Tab

Within the "Server" Page Tab, the user may enter or modify parameters for Server Debug Window Start-up, Server Shutdown or Log Trace Files.

In the **"Debug Interface"** frame, there are two Option Buttons to define server start-up parameters :

- Active,
- Not Active.

The default setting is "Not Active" meaning that the server appears only as an icon in the taskbar. When in this state, you cannot open the server window, i.e. you cannot access the server debug features.

If you want to know what is appended when the server is started and when your client application calls each OPC interface, you need to activate the server debug interface. Note however, that this option is reserved for advanced users, since you could modify the state of an OPC group without using the dedicated interface from the client application. Above the "Active" Option Button, there is an empty location for a hidden button. Add the "/HIDE" option in the OFSconf.exe shortcut, if you wish to show the "Hidden" Option Button.

How to add an option will be discussed in section 3.12 "OFSConf options".

The "Hidden" option hides the server (no window, no icon in the taskbar). This could be useful if you don't want the end user to be able to close the server during a session. The user then has no means of knowing if the Server is running except, **under NT only**, using the Windows NT Task Manager (press shift + ctrl + esc), "Processes" tab, search OFS.exe.

Within the "Shutdown" frame, you can customize the server shutdown procedure. Typically, this is useful in a DCOM environment with remote clients, to warn each client that the shutdown procedure is in progress. Each client must be properly disconnected from the server before the end of server shut-down else the link with the server will be lost.

The Shutdown Batch File offers the user the means to perform certain pre-programmed actions before Server shutdown (e.g.: send message warning Client of imminent shutdown).

The supplied batch sample :

"C:\Program Files\Modicon Telemecanique\OFS\Server\shutDown.bat"

demonstrates how to send a message to a remote client PC under NT. You need to customize this batch (edit it under NotePad) to indicate the name of the remote computer on *your* network.

A Shutdown Batch File name may be entered in the Text Box provided or found using the Browse facility, (the yellow "open" toolbar and the "open" menu become available when you focus on the pathname type textboxes). An alternative way is to drag and drop a batch file from Windows Explorer to OFSconf.exe

To enter text from the keyboard, place the pointer in the Text Box and click. The pointer changes into the familiar text entry cursor. Validate your choice by clicking the "OK" button to the right of the Text Box.

Additionally, a Shutdown Counter is provided where a numeric delay in seconds before the batch file is executed, may be entered. This counter is only used if a shutdown batch file name has been specified. Default setting is 10 seconds.

The "Log Trace" frame offers the user the possibility to store debugging traces in a file.

Three Text Boxes for pathnames are provided for entry of Log Trace File names used in Debug, Xway or Modicon protocols respectively.

An option is also provided in the form of a checkbox whether to overwrite the previous log file. If selected of course, the contents of the previous log file are lost.

The "OPC spy mode" when checked, offers an enlarged option for debugging traces.

"Debug trace SDK symb" is associated with symbol management.

"Debug trace SDK opt" is associated with communication requests.

After server start-up, you can dynamically overwrite those options for the current server session only, via the "Misc.", "Spy mode", "Debug Symbol" and "Debug Request" menus, available when the "Debug Interface" is activated.

3.3 Symbols Tab

Within the "SYMBOLS" page, the user may define or edit the link between a Symbol Table file **extension** and Symbol Table file format recognised by the server.

By default, the grid is automatically populated with the following :

SUFfix	**Type of symbols table file**
SCY	PL7 exported symbols table file
FEF	PL7 exported application file
TXT	ModSoft exported symbols table file
PRJ	ConCept project file
CCN	ConCept exported symbols table file
CSV	Comma Separated Values file

To define or edit an extension (generally three letters without a dot) :

- Double click on an empty or occupied field respectively in the "SUFfix" column. A Dialog Box opens prompting you to enter/edit a file extension,
- Click on "OK" - the file extension is entered/modified in the selected field,
- Double click on the corresponding field in the "Type of Symbol Table file" column. A List Box opens displaying the available file formats. These are :

  1. PL7 exported symbol table file,
  2. ConCept exported symbol table file,
  3. PL7 database (not available for the first version of the product),
  4. ConCept database (requires the ConCept OFS Programming Workshop installed on the PC),
  5. Modsoft exported symbol table file,
  6. Comma Separated Val (comma, space or tab separator in a text file generated by MS Excel).

- Click on your choice of file format, then click on "OK" - the chosen file format is then entered in the selected field of the "Data base or neutral file" column.
- A click of the right mouse button displays a pop-up menu of supplementary editing options which change according to which zone of the page the pointer is positioned. The full complement of options are:

  - Sort the column,
  - Add an item,
  - Modify this field,
  - Delete all the row,
  - Erase field(s).

Note :

Do not specify the dot separator to the left of each extension.

In the "**Consistency** appli. in PLC / Symbols file" frame, you can specify what level of safety you want for the coherence between the symbol tables and the application in the PLC :

- Strict level : on difference, the connection with the device will be rejected,
- Read only level : on difference, the device will be in read only mode,
- Warning level : on difference, a warning is returned to the client application.

3.4 Alias Tab

The **"Alias"** page allows the user to define/edit a label corresponding to a network driver, a PLC address and, if it exists, the symbol table of the variables used.

To define/edit an Alias :

- Double click on an empty or occupied field respectively in the "Alias" column. A Dialog Box opens prompting you to enter or edit respectively the Alias string,
- Click on "OK" - the Alias string is entered/modified in the selected field,
- Double click on the corresponding field in the "<driver>:<PLC addr>" column. A Dialog Box opens, displaying a list of Alias drivers and prompts the user to choose one and enter/edit the corresponding PLC address. If the Alias driver is for a network using TCP/IP, the option is also given to enter/edit a DNS name. In this case, it is the definition entered/edited last (DNS or definitive PLC address) that appears in the selected field of the "<driver>:<PLC addr>" column on clicking "OK". For MBT, an additional "Bridge" index could be entered.

A **P**re**L**oa**D** option (PLD Column) exists for the case when a symbol table is very large and would normally take several minutes to load. When selected (by entering a 1 in the "PLD" column), the Preload option causes the symbol table to be loaded at Server start-up and no longer at the first creation of an item for the device. The Preload option is disabled by entering "0" (zero) or by deleting the content of the cell in the "PLD" column.

Symbol tables may be defined by their entire path name or just by a file name which has been previously defined in a Default file folder. The Default file name and path may be entered from the keyboard in the Text Box provided, it may be browsed or located with the Windows Explorer then "Dragged and Dropped". Click on the "OK" button to validate.

Aliases may be created dynamically by a special tool - the "Extra Dynamic Alias" Text Box allows the user to define the number of entries available for extra Aliases. Enter the desired number in the Text Box and click on the "Extra Dynamic Alias OK" button to validate. Default is 5 extra aliases.

The last column, "Comment", allows optional entry of a comment associated with an alias.

- A click of the right mouse button displays a pop-up menu of supplementary editing options which change according to which zone of the page the pointer is positioned. The full complement of options is :

  - Sort the column, Add an item, Modify this field, Delete all the row, Erase field(s),

  - NotePad (to be used on text files only).

- The "Options" > "Preload all" allows checking of the PLD column for each alias having a symbols table. Click again on the menu to uncheck the menu and reset the PLC column.

We recommend the defining of aliases if the end-user wishes to use the OPC browse feature which shows the symbols to be entered in the OPC groups directly from the client application.

Note :

It is not recommended to use more than one alias, simultaneously, for the same device with an associated symbol table. Only the symbol table of the first alias used for that device will be loaded into memory.

3.5 Analog Tab

The **"Analog"** page is used for "Deadbanding" purposes. It permits the user to define a Variable Range Label and assign minimum and maximum values to it. For each value, the Deadband is a percentage of the range assigned to that value. The Deadband percentage is a Group attribute and serves to filter the notification of when a float value changes.

To define/edit a Variable Range Label :

- Double click on an empty or occupied field respectively in the "Analog Type Name" column. A Dialog Box opens prompting you to enter or edit respectively, the label string,
- Click on "OK" - the label string is entered/modified in the selected field,
- Double click on the corresponding field in the "LOW Eng. Unit" column. A Dialog Box opens, prompting the user to enter a numeric value corresponding to the low end of the range,
- Double click on the corresponding field in the "HIGH Eng. Unit" column. A Dialog Box opens, prompting the user to enter a numeric value corresponding to the high end of the range. Click on "OK" to finish.

  Note :

  The Configuration Tool will not permit a value **less** than that entered in the "LOW Eng. Unit" field, to be entered in the "HIGH Eng. Unit" field.

- A click of the right mouse button displays a pop-up menu of supplementary editing options which change according to which zone of the page the pointer is positioned. The full complement of options is :
  - Sort the column,
  - Add an item,
  - Modify this field,
  - Delete all the row,
  - Erase field(s).
- Click on the desired option to perform the action on the selected field.

Example of analog type :

Analog Type Name	**LOW Eng. Unit**	**HIGH Eng. Unit**
AnalogType	-1.5	+2.4

3.6 MB serial Tab

Since the first version of OFS does not provide the support of ModBus serial protocol, this tab is a future extension that allows parameter definition of the four serial ports COM1 to COM4.

3.7 Simulator Tab

The Simulator is merely an instance of the Server running without any real devices connected. It is used typically in the DEMO version of the product.

A number of controls are provided for configuring the Simulator operation.

- In the "Simulator tuning" frame :

  - **Factor :** relates to the time period by which variables are updated. If set to "1" (the default value), simulated variables are modified at the update rate of the group and each time a "read device" is performed (Synchronous or Asynchronous). If set to "N" (where N is an integer value greater than 1), there would be one chance in N that the simulated variable would be modified. Enter a positive numeric value in the Text Box and click the "Max Value" button to validate.

  - Max Value : indicates the maximum value for the simulated variables.

- In the "Initialization Values" frame :

  When started, the Simulator initializes variables according to how the following mutually exclusive Option Buttons are set :

  - **Random :** if selected, the Simulator variables are initialized to random values not exceeding the value entered in "Max Value",

  - **Not random :** if selected, all variables are initialized to zero and on incremented 1 by 1 to maxi value.

3.8 Misc. Tab

The "**Misc**ellaneous" page presents a number of operational features which may be enabled/disabled by checking the corresponding Checkbox.

- In the "Features" frame these are :

  - **Change PLC status :** when checked, allows the Server to change the operating mode of the PLC (eg. RUN -> STOP or STOP -> RUN) else the client application will receive the "EOL_E_FEATURE_DISABLED" error : *This feature has been disabled by the administrator*,

  - **DNS scanning :** when checked, authorizes the Server to use DNS to identify PLCs,

  - **Change Activity :** when checked, authorizes the active attribute of an item or group to be modified from the Server Debug Interface. For safety reasons, you may wish to disable this option. In that case, only the client application can modify the active property of the group,

  - **OPC Extensions :** when checked, authorizes use of Schneider Automation OPC extensions and custom interfaces, designed by Schneider and not part of the OPC Specification,

  - **DCOM Security :** when checked, DCOM security is active. In case of a problem of remote connection with DCOM, it may be useful to disable the DCOM security in order to gain free access to the OPC Factory Server,

  - **Verify Devices :** when checked, verifies that a device is connected when a variable for it is created, for the FIRST TIME ONLY. Else the device presence verification will be postponed to the reading or writing of the variable,

  - **Dynamic Config** : allows dynamic configuration without restarting the server. When checked, the external tool :

    C:\Program Files\Modicon Telemecanique\OFS\Server\STLoader.exe,

    Can be started to refresh symbol tables and dynamically create extra aliases according to the number specified in the Extra Dynamic Alias number in the "Alias" tab.

- In the "Group" frame these are :

  - **Min Update Rate :** the "Group" Text Box allows the user to specify a numeric value in ms, for the minimum update rate of a variable,

  - Enter the value in the Text Box, then click on the "Min Update Rate" button to validate. Default setting is 500 ms.

3.9 Advanced Tab

A number of options are offered for advanced users.

- In the "Time-out" frame :

  - The **ModBus** and **Unite** Text Boxes allow the user to enter a positive numeric value in milliseconds. for the respective device time-outs. Enter the value and click on the corresponding "OK" button to validate. Default setting is 1000 ms. for both time-outs.

- In the "Avoid driver contention" frame :

  - **Max. Pending Req. :** is the value of the maximum number of messages that may be queued for a device. Enter the value and click on the "MaxPendingReq." button to validate. Default setting is 20.

- In the "Impact on the CPU loading" frame on the "server" machine :

  - **XwayRec Rate :** This parameter is specific to the XWAY network. It is the numeric value in milliseconds, at which the message reception task is executed (typical value - 50 to 100). Too small a value increases the CPU overhead. Enter the value and click on the "XwayRcvRate." button to validate. Default setting is 100 ms.

3.10 GUI : Menus, Tool Bar and Status Bar

The Menus and Toolbar of the OFS Configuration Tool contain the usual copy, cut, paste, toolbar buttons plus some additional ones :

- **RegEdit :** the system editor for the registry. See the **"caution"** reminder in the next chapter. RegEdit gives complete access to the registry. OFSconf is a registry editor only, dedicated to OFS,
- The **"Open"** toolbar is available only on "pathname" type textboxes,
- **DCOM :** the DCOM drop-down menu offers the facility to verify if DCOM is installed on your PC under Windows 95 and if so, to run the DCOM Configuration Tool (can also be run from an icon). Under NT4, DCOM is installed by default,
- **Print :** prints the current configuration in a text file (can also be run from an icon),
- **Options :** offers various page alignment and resizing options on the grid,

Some standard icons are also provided :

- **NotePad :** runs the Windows NotePad accessory. Useful to edit Symbol Table files and Log trace,
- **Calc :** runs the Windows Calculator accessory for convenience.

In the **status bar**, before the date, there is a counter of missing **mandatory** information in a grid or in a textbox. If you quit the software without fixing the missing data displayed in red with the label *<mandatory>*, a warning is displayed. It is recommended that the counter be maintained at zero else the server could fail.

A warning is also displayed if you forget to validate the new value in a textbox by <enter> or by clicking on the "OK" button.

3.11 Saving/Restoring Configuration

You need to run RegEdit, the system utility which allows the user to view the Windows registry directory for the OFS and/or copy it to another PC.

To copy or save the configuration data :

1. Click on the **"RegEdit"** icon - the Registry Editor Window opens. All configuration data are stored under the following Registry key:

   HKEY_CURRENT_USER\Software\Schneider Automation**OpcSrv**

   Explore the path shown above until the branch is completely open.

   Click on the **"Registry"** menu and from the drop-down, click on **"Export Registry File"**. A Dialog Box opens,

2. Click on **"Selected Branch"** in the "Export range" frame, then enter the destination path and file name with a **.reg** extension and "Save",

3. Transfer the file to the destination PC, then **double click on the .reg** file. The destination PC registry data is then updated.

Caution:

Be careful! Any modifications in the registry should be done by advanced users only. There is no "undo" and it's possible to crash your PC if you accidentally modify or delete a wrong key.

3.12 OFSconf Options

The OFSconf options can only be set in the shortcut.

METHOD :

1. "Start" > "Settings" > **"Taskbar & start menu"**,
2. Click **"Advanced"** button,
3. Go to C:\WINNT\Profiles\All Users\Start Menu\Programs\Modicon\Telemecanique**OFS Configuration Tool.lnk,**
4. Right-click > **"Properties",** 2nd tab "Shortcut",
5. Go to the field :

   Target = "C:\Program Files\Modicon Telemecanique\OFS\OFSconf\OFSconf.exe"
6. Add the option after the last quote which appears only if there are space(s) in a long name,
7. Click "Close" button.

Example:

Target = "C:\Program Files\Modicon Telemecanique\OFS\OFSconf\OFSconf.exe" /HIDE

Note :

Do not forget the *space* separator before the slash of each option.

Known options :

- **/HIDE** show "hidden" option in the "Server" tab: hide the server icon.
- **/RESET** reinitialize all the parameters in the registry. Be careful! This means that you lose all your previous configuration.

4.1 Definition of a Group of Items

All of the services of the OFS product are based on the concept of a **group of items** : a group of variables of any PLC which can be accessed either by their addresses or by their symbols.

- It is possible to define several groups,
- A group may concern several PLCs : each item may have a different PLC address,
- A group concerns various communication media and PLCs : each item may refer to a different communication driver. If a PLC can be accessed via several communication media, it is possible to mix variables addressed via different media within one group,
- A group can be made up of different types of item : it is possible to mix all the types of object managed by the OFS server,

  Example :

  Mixing words, double words and floating points within one group.
- Depending on the service called, a group is transcribed on one or more communication requests,
- All items in the same group share the update rate and deadbanding percentage.

4.2 Synchronous Services : Read / Write

- These services are used for partial or complete reading or writing of a group of items.
- The periodic scanning of the evolution of variables (read polling) must be handled by the client application.
- The term **"synchronous"** means that the client application which calls up these read or write services is blocked for the time during which the result is being obtained. The instruction which follows a synchronous read or write call in the code of the client application will only be executed when all the communication requests corresponding to that call have been processed. This term does not mean synchronization with the PLC. It means that, during a synchronous read operation, the OFS server **does not guarantee** that all the variables in a group will be ***read in the same PLC scan*** if this group is ***transcribed on several*** communication requests. The OFS server provides a mechanism for ascertaining the number of requests necessary to **read the whole** of a group of items (only for synchronous groups).

Note :

The conditions ensuring that the items in a group are consistent with one another (read or written in the same PLC scan) are described in Sections 6.5 and 6.6.

4.3 Asynchronous Services

- These services are used for partial or complete reading or writing of a group of items.
- The periodic scanning of the evolution of variables (read polling) must be handled by the client application.
- The client application is not blocked for the time during which the data are being obtained.
- The results values are notified to the client using the notification mechanism (this latter should be enabled).
- For the synchronization with the PLC, everything discussed for synchronous services is valid (see 4.2).

4.4 Periodic Read Service

The periodic scanning of variables : read **"polling"** and the **notification** of the change of their value are handled by the OFS server.

- The client application must program a function called **"WakeUp"**, on which it will be informed (notified) by the OFS of the changes in value which have occurred on the items of all the groups which are scanned periodically.
  This means that the "WakeUp" function is unique in the client application : it receives all the notifications from the OFS server, then it must redistribute them to the processing functions specific to each group which is scanned periodically.

  Note :

  For ready-to-run supervisory software, the "**WakeUp**" function should be pre-programmed. If it is not the case, the notification mechanism may not be used.

  The name of this "WakeUp" function is set by the OPC standard : ***OnDataChange.***

  Warning :

  Processing which takes up a significant amount of CPU time (eg : display which is too complex) should not be performed in the "WakeUp" function, as this may adversely affect the performance of the Operating System.

- The OFS server performs the **notification by group**, and not individually by item. This means that, for a given group, the OFS server transmits the list of items whose value has changed to the client application "WakeUp" function.
  In the case of a table type item, the OFS server transmits the whole table even if only a subset of the elements has changed in value.

The following concepts are associated with the periodic read service :

- Assignment of a scanning **PERIOD** (*"RATE"*) to a group : time between two read operations during the "polling" performed by the OFS server. This concept reflects the need to monitor the variables at different rates.

  Example :

  Display the PLC time every second, and display a temperature every minute.

- Assignment of **DEAD-BANDING** to a group : filtering of the notifications when the values of the variables of the group change. The notification takes place if, at the end of the group scanning period, variables have changed by more than a certain percentage with respect to their old value (see Section 6.9 for the use of dead-banding).

  Example :

  Inform the client application only if temperatures have changed by more than 10%.

Note :

Dead-banding is **only** applied to **floating point** variables.

The purpose of these two concepts is to be able to control (limit) the flow of the notifications sent to the client application, to avoid saturating the system.

4.5 Mechanism for Adjusting the Communication Time-Out with a Device

This mechanism enables the user to **view** or **modify** the communication **time-out** with a given device. This time-out is the period during which the OFS server waits for an answer from a given device after sending it a request.

The default values can be set using the configuration tool (see 3.9). These defaults values apply either to all XWAY devices or all MODBUS devices.

Modification of the time-out for a given device is possible using a specific item (see 6.10).

4.6 Mechanism for Managing the PLC Operating Mode

This mechanism enables the user to **view** or **modify** the **operating mode** of a PLC : Run, Stop and Init.

Note :

The OFS server only provides the basic service for changing the operating mode of a PLC. Since the change of state of the PLC may have repercussions on the process, **all the preliminary checks are the responsibility of the client application**.

Example :

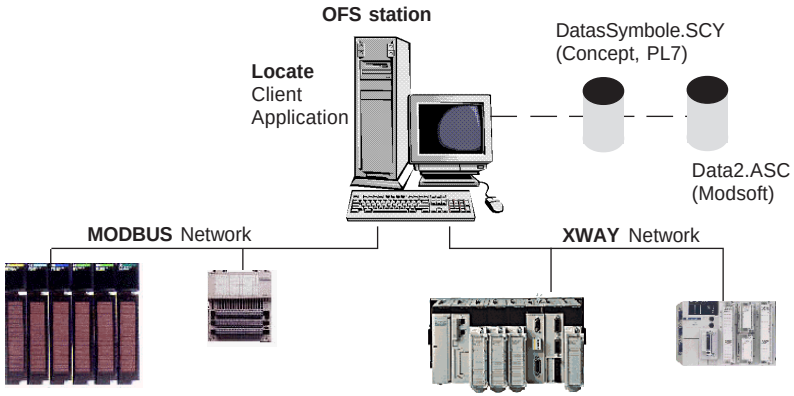
Programming a message in the client application requesting the operator to confirm the change of the PLC operating mode.

4.7 Mechanism for Accessing the OFS Server

There are two methods of accessing the services provided by the OFS server.

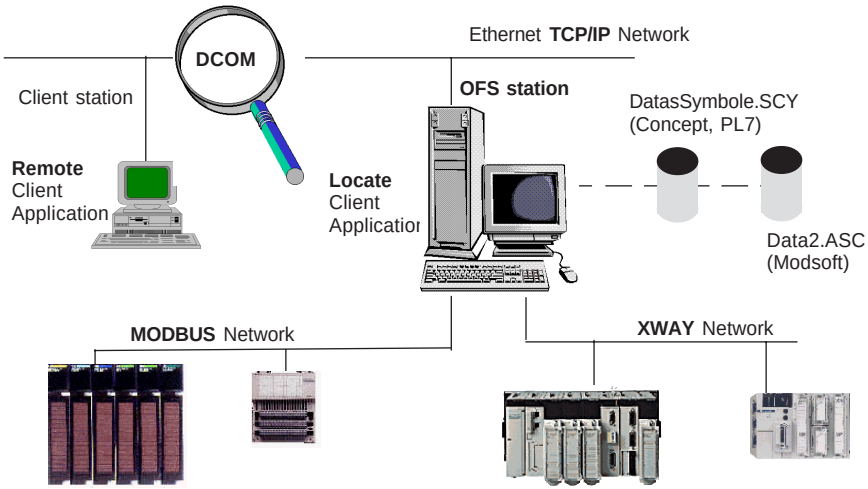
- Local access

  The client application and the OFS server are on the same station.



- Remote access via DCOM

  The client application and the OFS server are on separate stations, connected via the Microsoft TCP/IP network :



4.8 Symbolic Support

Symbolic support enables the replacement of the address of any variable in the item definition, by it's name in the PLC application (ex: use "Symb1" instead of the Xway address "%MW1" or instead of the Modsoft address "400001"). It is handled as a string substitution and has no effect on Read/Write operations.

The supported symbol table formats are:

- PL7 exported symbol table file,
- Concept exported symbol table file,
- Modsoft exported symbol table file,
- CSV symbol table file (Excel exported format).

For more detail, see 6.13

4.9 Browse Support

The OPC Browse Interface is supported by the OFS product. This enables users to browse symbols available for a given PLC, provided that the OPC Client used, supports the Browse interface. This is an easy way to determine which variables can be created for a given device.

Note :

Only PLCs declared with the Configuration Tool and associated with a Symbol Table can be browsed.

4.10 Concept Link

The direct link with the Concept database enables :

- Symbolic Support,
- Browse Support,
- Access to unlocated variables and to structured data.

Concept and OFS can run simultaneously on the same Concept project. More than one Concept project can be open at a time (see 6.16).

4.11 Simulator

The Simulator enables testing of the application without the actual devices. It provides a simple animation of all created variables. Except for device access, it is identical to the actual Server.

Note :

The only restriction is that it does not support writing to array items.

Preface :

This section gives an **exhaustive list** of the various types of objects managed by the OFS server, and indicates the access permitted for each type : read only (R) or read/write (R/W).

The general syntax for an item is :

<**item**>::=<**Driver Name**>:<**Device Address**>!<**Variable Definition**>[:<**array length**>[;<**postfix**>]]

The **<Driver Name>:<Device Address>** part can be replaced by an alias created with the Configuration Tool (see 3.4).

If an alias is not used, **Driver Name** should be one value of the following list and the **Device Address** is the address of the device on the communication medium :

Driver Name	Example of Device Address	Communication Medium
UNTLW01	0.254.0	UNI-TELWAY
FIP01, FIP02	0.31.0	FIPWAY adapter 01 or 02
ISAWAY01, ISAWAY02	0.5	ISAWAY adapter 01 or 02
ETHWAY01	0.5	ETHWAY adapter 01
XIP01, XIP02, XIP03	0.5	XWAY TCP/IP adapter 01 or 02 or 03
MBP00,MBP01	PM.12 or DM.15.3	MODBUS+ adapter 0 or 1
MBT	139.160.218.102	MODBUS TCP/IP

The **Variable Definition** part can be either a variable address (see the "Syntax" column in the other tables of this chapter) or a symbol (see 4.8).

For Modbus+ users, if you plan to use **simultaneously Concept** and **OFS**, use **DM paths**. Otherwise you may not be able either to connect to the PLC with Concept or to download your application.

For the variables that support this feature, the **array length** part enables the user to create items that are actually arrays and gives the number of the array element.

The **Postfix** part can be **R** : **R** means **READ-ONLY** and is a way to create an item that will always be considered as **READ-ONLY**.

For Modsoft variables, **F** and **D** postfix values are also supported (see 5.3).

Note :

The **Driver Name, Device Address** and **Variable definition** are **mandatory.**
The **array length** and the **postfix** are **optional.**

Examples :

"FIP01:0.31.0!%MW12"	"XIP01:0.5!%MW100:10"
"XIP02:0.5!%MW100;R"	"MBP00:DM.1.2!400001"
"TSX2!Toto"	"QTIP!Titi"

Note :

The MBT **Device Address** field uses a postfix of ";xx" to designate the destination index used in the Modbus+ mapping table defined in the Ethernet to Modbus+ bridge. The "xx" is the decimal value of the index. For example, "139.160.218.103;50".

5.1 PL7 Variables

5.1-1 Standard Objects

• System objects :

Object	Syntax	Access	TSX 37	PCX/TSX 57
System bit	%Si	R[/W]	Y	Y
System word	%SWi	R[/W]	Y	Y
System double word	%SDi	R[/W]	Y	Y

Note :

Some of these objects can only be modified by the system : the PL7 workshop installation manual indicates exactly the type of access (R or R/W) permitted for each of the system objects defined.

• Memory objects (variables and constants) :

Object	Syntax	Access	TSX 37	PCX/TSX 57
Internal bit	%Mi	R / W	Y	Y
Internal byte	%MBi	R / W	Y	Y
Internal word	%MWi	R / W	Y	Y
Internal double word	%MDi	R / W	Y	Y
Floating point (32 bits)	%MFi	R / W	Y	Y
Constant word	%KWi	R	Y	Y
Constant double word	%KDi	R	Y	Y
Floating point constant (32 bits)	%KFi	R	Y	Y
Common word on network 0	%NW{j}k j = station no. k = word no.	R / W	Y	Y
Common word on other networks	%NW{i.j}k i = network no. j = station no. k = word no.	R / W	Y	Y

Note :

The OFS server does not permit direct access to **word extract bits**, unlike PL7 language. To access a particular bit of a word, a client application programmed with the OFS server must access the word using a read primitive and itself apply the "mask" necessary to extract the required bit(s).

5.1-2 Grafcet Objects

Object	Syntax	Access	TSX 37	PCX/TSX 57
Step state	%Xi	R	Y	Y
Activity time of a step	%Xi.T	R	Y	Y
State of a step in a macro-step	%Xj.i	R	N	Y
Activity time of a step in a macro-step	%Xj.i.T	R	N	Y
State of the IN step of a macro-step	%Xj.IN	R	N	Y
Activity time of the IN step of a macro-step	%Xj.IN.T	R	N	Y
State of the OUT step of a macro-step	%Xj.OUT	R	N	Y
Activity time of the OUT step of a macro-step	%Xj.OUT.T	R	N	Y

Note :

The macro-steps on available only on PCX/TSX 57 version 3.0 or later.

5.1-3 Standard Function Blocks

Object	Syntax	Access	TSX 37	PCX/TSX 57
PL7_3 timer : %Ti				
Current Value	%Ti.V	R	Y	Y
Preset Value	%Ti.P	R / W	Y	Y
Done Output	%Ti.D	R	Y	Y
Running Output	%Ti.R	R	Y	Y
IEC 1131-3 timer : %Tmi				
Current Value	%TMi.V	R	Y	Y
Preset Value	%TMi.P	R / W	Y	Y
Working Output	%TMi.Q	R	Y	Y
One-Shot : %Mni				
Current Value	%MNi.V	R	Y	Y
Preset Value	%MNi.P	R / W	Y	Y
Running Output	%MNi.R	R	Y	Y
Counter Up/Down : %Ci				
Current Value	%Ci.V	R	Y	Y
Preset Value	%Ci.P	R / W	Y	Y
Empty Output	%Ci.E	R	Y	Y
Done Output	%Ci.D	R	Y	Y
Full Output	%Ci.F	R	Y	Y
Register : %Ri				
Input Word	%Ri.I	R / W	Y	Y
Output Word	%Ri.O	R	Y	Y
Full Output	%Ri.F	R	Y	Y
Empty Output	%Ri.E	R	Y	Y
Drum : %Dri				
Full Output	%DRi.F	R	Y	Y
Number of current step	%DRi.S	R	Y	Y
Activity Length	%DRi.V	R	Y	Y

5.1-4 Table Objects

Reminders :

In read mode, the size of the tables is unlimited, except for bit tables (system and memory), which are limited to 450 elements.

• Tables of system objects :

Type of element	Syntax	Access	TSX 37	PCX/TSX 57	Max. write size
System bit	%Si:L	R	Y	Y	-
System word	%SWi:L	R[/W]	Y	Y	58
System double word	%SDi:L	R[/W]	Y	Y	29

Note :

Access to system objects using the table syntax constitutes an extension to PL7 language. The system objects defined in the TSX 37 and PCX/TSX 57 ranges are not all consecutive, which may limit access using the table syntax in some cases.

• Tables of memory objects :

Type of element	Syntax	Access	TSX 37	PCX/TSX 57	Max. write size
Internal bit	%Mi:L	R / W	Y	Y	450
Internal word	%MWi:L	R / W	Y	Y	58
Internal double word	%MDi:L	R / W	Y	Y	29
Floating point (32 bits)	%MFi:L	R / W	Y	Y	29
Constant word	%KWi:L	R	Y	Y	-
Constant double word	%KDi:L	R	Y	Y	-
Floating point constant (32 bits)	%KFi:L	R	Y	Y	-
Common word on network 0	%NW{j}k:L j = station no. k = word no.	R/W	Y	Y	4
Common word on other networks	%NW{i.j}k:L i = network no. j = station no. k = word no.	R/W	Y	Y	4
Character string	%MBi:L	R/W	Y	Y	116

Notes :

- Access to common words using the table syntax constitutes an extension to PL7 language.
- The address (i) and the length (L) of a character string %MBi:L must be even.

• Tables of Grafcet objects

Type of element	Syntax	Access	TSX 37	PCX/TSX 57	Max. write size
Step state	%Xi:L	R	Y	Y	-
Activity time of a step	%Xi.T:L	R	Y	Y	-
State of a step in a macro-step	%Xj.i:L	R	N	Y	-
Activity time of a step in a macro-step	%Xj.i.T:L	R	N	Y	-
State of the IN step of a macro-step	%Xj.IN:L	R	N	Y	-
Activity time of the IN step of a macro-step	%Xj.IN.T:L	R	N	Y	-
State of the OUT step of a macro-step	%Xj.OUT:L	R	N	Y	-
Activity time of the OUT step of a macro-step	%Xj.OUT.T:L	R	N	Y	-

Note :

Apart from "step state", access to the other Grafcet objects using the table syntax constitutes an extension to PL7 language.

Reminder :

The macro-steps are available only on PCX/TSX 57 version 3.0 or later.

Additional information about macro-steps tables :

• The syntax %Xj.i:L consists of reading several consecutive steps (number L) of the macro-step (j).

Example : %X1.0:3 corresponds to %X1.0, %X1.1 and %X1.2.

• The syntax on a particular step (IN or OUT) of a macro-step (j) consists in reading this step for several consecutive macro-steps (number L).

Example : %X1.IN:3 corresponds to %X1.IN, %X2.IN and %X3.IN.
%X1.OUT.T:3 corresponds to %X1.OUT.T, %X2.OUT.T and %X3.OUT.T.

5.2 Concept Variables

StateRam Objects	Range	Item Syntax	Access	Array
		IEC-1131		
Coils	0x	%Mi	R / W	%Mi:L
Input Status	1x	%Si	R	%Si:L
Input Reg as UINT	3x	%SWi	R	%SWi:L
Holding Reg as UINT	4x	%MWi	R / W	%MWi:L
Holding Reg as UDINT	4x	%MDi	R / W	%MDi:L
Holding Reg as REAL	4x	%MFi	R / W	%MFi:L

Symbols are supported everywhere and all variables are represented by symbols since there is no address syntax in the Concept language.

As an extension to the Concept language it is possible to use (Located Variables only) the IEC 1131 Syntax.

Example :

Variable "Toto", located on register 400023 can also be accessed by %MW23 (UINT) or %MF23 (Real) or %MD23 (UDINT). For %MF23 & %MD23 registers 23 and 24 are actuallyread. The syntax Toto:5 or %MW23:5 means an array of five registers starting at Toto (=400023).

The structures are supported. It is possible to access a structure either as an array of bytes (it is up to the user to know the internal fields and their type) or field by field with the syntax :

<structure name>.<field name>

In that case, the server figures out the data type directly from the ConCept database.

Note :

Structure access may only take place with a device associated with a Concept project file (*.prj) as a Symbol Table file. Both located and unlocated devices may be accessed if the above is true.

To easily manipulate a structure, it is possible to create a group and into that group to create an item for each field of the structure.

Notes :

- Access to **unlocated variables and structures** is ONLY possible if the **IEC runtime** has been **enabled** into the PLC configuration.

- Moreover **unlocated variables and structures** should be really **used into your PLC application** to be **readable/writeable** with OFS. Actually with Concept, any unused unlocated variables is not known by the PLC.

5.3 ModSoft variables

The Modsoft supported syntax **is only long addresses (6 digits)** for the moment.

Ex: 400001.

The following syntaxes are NOT supported **(do not confuse with array syntax)**:

- 4:00001,
- 40001,
- 4x00001.

The access to any registers located into the 6x range-id is not possible.

The array syntax <reg number>:<length> is supported for range-id 0,1,3,4.

It enables you to read not only one register at a time but many registers (actually <length> registers).

For Holding registers, it is possible to create an item as a **Float** or as a **Long int** using a postfix of **F** or **D**. Two consecutive registers will be used. The usual **R** postfix can be used at the same time.

Example : 400001;F Float for registers 1 & 2.
400012;D Long int (32 bits) for registers 12 & 13
400120;FR Float considered as read-only for registers 120 & 121

Object	Range	Item Syntax	Access	Array	Max Size Write
Coils	0	00000i	R/W	00000i:L	800
Input status	1	10000i	R	10000i:L	-
Input register	3	30000i	R	30000i:L	-
Holding register	4	40000I	R/W	40000I:L	100

Reminders :

In read mode, the size of the tables is unlimited, except for bit tables (system and memory), which are limited to 2000 elements.

5.4 Local Variables

A pseudo-protocol (driver name: **"LOCAL"**) is supported to enable the creation of variables that are only local to the server (no relation with any hardware device). Those local variables are always of type WORD (VT_I2), created with a name.

Syntax : **"LOCAL"** : ! <**name**>

Example : "LOCAL:!Bridge"

If two or more clients create the same local variable (same name), the value is shared which means that if one client changes the value the other(s) will be notified (if enabled). As long the value has not been written (after creation) the quality is reported as bad. This feature can be used typically to exchange data from one client to another.

6.1 Introduction

Before the OFS server can be operated, it must first of all be installed (see Section 2) and Configured (see Section 3). After these two phases, the OFS server is ready for use.

Note :

When using ready-to run supervisory software, you may not have the ability to use all the features that are listed in the following chapter (see the documentation of the OPC interface of your supervisory software to verify that point).

- Configuration

  Using the Configuration Tool described in Section 3, the user may :

  - configure Symbol Tables,
  - configure Aliases and Addresses,
  - select other options.

- Operation

  The Client should start the Server and initiate communications. Then the user may:

  - create groups,
  - create items,
  - perform synchronous Read,
  - perform synchronous Write,
  - enable notification for the group,
  - activate the group.

  At this time the server should send the notification of value changes automatically.

6.2 The Operating Phases of the OFS Server

The main phases to be followed when **programming** a client application are as follows :

- Creation of the OFS SERVER :
  CreateObject(...) primitive,
- Creation of the GROUPS of items :
  AddGroup(...) primitive,
- Creation of the ITEMS in a group :
  AddItems(...) primitive,
- READ or WRITE the items in a group :
  OPCRead(...) or **OPCWrite(...)** primitives; or **ActiveStatus(...)** property,
- Removal of groups :
  RemoveGroup(...) primitive,
- Removal from the server.

The periodic reading of a group of items requires the following additional operations :

- Use of notification :
  - Subscription to the notification service :
    AddCallbackReference(...) primitive,
  - Periodic reception of notifications ("WakeUp" function) :
    OnDataChange(...) primitive,
  - Removal of the subscription to the notification service :
    DropCallbackReference(...) primitive,
- Management of dead-banding :
  PercentDeadBand(...) property.

The OFS server provides the following additional services :

- Obtaining information on the OFS server :
  - ***MajorVersion***, ***MinorVersion*** and ***BuildNumber*** properties,
  - ***StartTime*** and ***CurrentTime*** properties.
- Obtaining an error message :
  - **GetErrorString(...)** primitive.

Note :

The above information is required only when creating new, customized applications.

6.3 Groups of Items

The OFS product distinguishes 2 types of group :

- **User Group**
  - Any item can be located on any device
  - It is not possible to know the number of requests necessary to read the whole group
  - It is possible to perform a read of any part of the group
  - The group is notifiable
  - The group name can be any string.

- **Synchronous Group**
  - All items should be located on the same device
  - It is possible to know the number of requests necessary to read the whole group (# Nbr Request)
  - Even when performing a read of part of the group, all items are read
  - The group is notifiable
  - The name should start with a $ or $$
    - $: number of requests limited to 1
    - $$: any number of requests

A synchronous group can contain a ***"#NbrRequest"*** specific item which is used to ascertain the number of communication requests required to **read all** of a group of items.

This item is read only and is updated by the server each time an item is added, without having to physically read the group (no network communication time used).

This item can only be used in a synchronous group.

Note :

The tutorial in Section 7.2 provides an example of using the "***#NbrRequest***" specific item.

6.4 Managing Tables

- The OFS server manages **tables of variables**, thus providing easy access to a set of contiguous variables of the same type.
- The OFS server supports several syntaxes according to the target PLC :

  <SourceElement>:<Length>

  The <SourceElement> field represents either the address or the symbol of the first element in the table. The <Length> field represents the number of elements (of the same type as the source variable) in the table.

  Example :

  For a variable with address %MW10 and symbol MYARRAY.
  A table of 20 elements commencing with this variable can be referenced in the following two (equivalent) ways :

  %MW10:20
  MYARRAY:20

  Note :

  This is the only syntax which can be used to reference a table in symbolic form for **PL7** objects, as **tables cannot be symbolized** in the **PL7** language.
  The **Concept** language supports symbolic reference to a table. In any case this syntax can be used with both **Concept** & **Modsoft** variables.

- In **read** mode, the OFS server only limits the size of bit tables to the size than can be read with one request (450 bits for XWAY and 2000 bits for MODBUS). For other types of element, the **size** of the tables is **unlimited**. However, tables **should not exceed the zones configured** using the workshop.
- In **write** mode, the OFS server **limits** the size of tables : the maximum sizes according to the type of element are given in Chapter 5.
- A table of variables corresponds to a single item in a group.

  Reminder :

  This means that in the case of periodic reading of a group containing a table item, the OFS server sends the whole of the table to the client application, however many elements in this table have actually changed in value.

6.5 Consistency of the Read Operation

- Consistency of a group of items :

  The OFS server ensures that all the items in a group are consistent with one another (that is : read in the same PLC scan) if, and only if, the group is transcribed on a single request. This means that the client application can be sure of the consistency of the items accessed in read mode when the ***#NbrRequest*** specific item associated with the group or the device equals 1.

- Consistency of an item :

  For a single item (standard object, Grafcet object, etc), the consistency is implicit, as this item will only be attached to a single request.

  For a table item, the maximum number of elements which can be consistent with one another (read in the same PLC scan) depends on the communication medium :

Communication medium	**No. of elements consistent with one another (dep. on type)**					
	bits	words	double words & fl. points	common words	characters (string)	Grafcet
UNI-TELWAY (terminal port)	450	60	30	12	120	17
FIPWAY	450	60	30	12	120	17
ETHWAY	450	115	57	92	230	33
ISAWAY	450	115	57	92	230	33
XWAY TCP/IP	450	115	57	92	230	33
MODBUS+	2000	125	62	-	-	-
MODBUS TCP/IP	2000	125	62	-	-	-

Note :

The communication media ISAWAY, ETHWAY and XWAY TCP/IP allow to read 908 bits on a single request, with several tables (since bits tables are limited to 450 elements).

- When the name of a user group is **prefixed** with **'$'**, the OFS server checks each time an item is added that the number of requests does not exceed the unit. One then speaks of the **single request** user group.

  The OFS server (*AddItems* primitive) will not permit the addition of the item and indicates an error if a single-request group cannot be transcribed on a single request.

6.6 Consistency of the Write Operation

The write primitive exposed by the OFS server is used to write one or more items at a time in a group. It must be possible to modify the items and they must correspond :

- either to a **single** item, which may be any of the types which are handled,
- or to a **table** item of standard objects.

Note :

When there is a write request, the OFS server overwrites the old values in the PLC. **The client application must be responsible for the prior confirmation** of the overwriting, if this is necessary.

If, when there is a write request which applies to several items, there are overlaps between items, it is the value associated with the last of these items which takes priority.

Example :

If the write operation applies to items "%MW0:5" and "%MW0", the value given for the 1st element of item "%MW0:5" will be transient : it will only be retained in the PLC for as long as it takes for the request to write the second item ("%MW0") is taken into account.

Consistency of the variables with each other during a write operation

The consistency of the write operation is guaranteed at the level of the item, as each item is transcribed on a single write request (1 request per item). This means in particular that all the elements of a table item will be **written during the same PLC scan**, due to the size limits imposed on tables according to the type of their elements.

However, for a write request which applies to several items, the OFS server does not guarantee that all these items will be written during the same PLC scan.

Consequently, if a client application needs to write several contiguous variables to memory at the same time, it is recommended that these variables are referenced in the form of a single table item, rather than several individual items.

Example :

To simultaneously write variables %MW0 and %MW1, it is advisable to use the table item %MW0:2, rather than 2 separate items %MW0 and %MW1.

Note :

A group which can be read on a single request (*#NbrRequest* item = 1) is not necessarily written on a single request.

6.7 Asynchronous Operation

With Asynchronous operation, the call of any asynchronous operation will return immediately. It doesn't mean that the requested operation has been completed but that the operation was either rejected (bad return code) or is on the way (good return code).

The completion and the result of the requested operation will be notified using the notification mechanism. For that reason it should be enabled before using any asynchronous operation.

The four operations are :

- Read,
- Write,
- Refresh,
- Cancel.

Read/Write :

similar to the synchronous operation with the same name (same functionalities, same restrictions apply).

Refresh :

Ask for the notification of all the current values of all the active items of the group. The group should be active.

Cancel :

Can be used to stop an on-going Read, Write, Refresh operation. It is not possible to know if the on-going operation has actually been stopped.

6.8 Using Periodic Reading

The use of periodic reading of items in a group comprises 4 steps :

- Subscription of the group to the notification service set up by the OFS server.
- Programming of the *OnDataChange* "WakeUp" function called by the OFS server to notify changes in value which have occurred in the groups.
- Activation if not already done of all items that should be scanned
- Activation of the group to trigger the periodic scanning of the items of the group for which the OFS server is responsible : *ActiveStatus* property at TRUE value.

Note :

Synchronous reading and writing are possible during periodic reading.

Reminder :

- The *OnDataChange* primitive receives the notifications for **all the groups** for which the OFS server performs the read polling.

- The **notification** is performed **by group**, and not individually for each item in a group. The *OnDataChange* primitive thus receives the **list of the items** in the group which have changed in value from one iteration to the next of the read polling.

The periodic reading of a group is stopped in 2 stages :

- Deactivation of the group : *ActiveStatus* property at FALSE,
- Stopping of the subscription of the group to the notification service.

Note :

For User Groups : it is at any time possible to activate/deactivate any item in the group.
For Synchronous Groups : (name starting with $ or $$) all items are always considered as active i.e. no partial activation/deactivation possible.

6.9 Using Dead-Banding

6.9.1 Definition

Dead-banding is associated with the periodic reading of a **user group**, and is a method of **filtering notifications** of changes in the value of items : it avoids waking up the client application when the variable changes within a dead range around the last value received.

Comment :

The dead-banding mechanism does not reduce the flow of requests between the server and the PLC. It is used to reduce the number of notifications sent by the server, and thus processed by the client application : as a result, it **saves CPU time**.

6.9.2 Description of the Dead-Banding Mechanism

The OFS server uses dead-banding as it is specified in the OPC standard.

- Dead-banding **only concerns real variables : "%MF"**, called "ANALOG" variables by the OPC standard.

  Comment :

  The OFS server uses this OPC term to describe "floating point" type PLC variables, even though this term does not correspond to the idea of analog variables generally used in the control system field.

- Dead-banding is based on the following notions :

  - The **analog type**, defined with min. and max. limits which represent the range of values (interval) of the variables being handled.

  Example :

  AnalogType = [-1.0, 1.0]

  The max. limit for an analog type (1.0 in the example above) is called ***E**ngineering **U**nit high bound*. The min. limit (-1.0) is called ***EU** low bound*.

  - **Usual notification range**, which corresponds to the difference between the max. limit and the min. limit defined for an analog type.

  In the previous example :

  The usual range of variation of the "AnalogType" is : 2 = (1.0 - (-1.0)).

- **Notification threshold**, which conditions the transmission of a notification to the client application : the notification is transmitted if, and only if, the difference (in absolute value) between the value read and last value sent is above this threshold.

  The value of the threshold for an analog type is calculated by applying the dead-banding value defined for the group to the usual variation range for this type.

  The **dead-banding** is a **percentage variation** between 0 (ie : 0%) and 1.0 (ie : 100%).

  To summarize, for an analog type, the **notification condition** is as follows :
  ABS (Value read - Last value sent) > Dead-banding * (Max. limit - Min. limit)

Comment :

All notifications are sent if the dead-banding is 0% or 100% (default value). In the previous example :

If the dead-banding value assigned to the group is 10%, the notification threshold for the "AnalogType" is :

0.2 = 0.10 (dead-banding) * 2 (usual variation range).

This means that only those variables in the group whose value varies by a difference of more than 0.2 (in absolute value) will be notified to the client application.

6.9.3 Using Dead-Banding in a Client Application

- Declaration of the analog types :

  Use the Configuration Tool, see Section 3.5.

  Comment :

  "AnalogType" is the name given to the analog type by the user.

  Notes :

  - It is possible to define **up to 100 analog types**

  - The limits for an analog type **cannot be modified** by the user **once the server has started**. This is due to the fact that when it is started, the OFS server learns the analog types defined in the registry. The OFS server must be stopped and then restarted for an alteration of the limits of an analog type to be taken into account.

- Defining the dead-banding value :

  The dead-banding value associated with a user group can be set when the group is created (*AddGroup* primitive) or dynamically adjusted during the server session (*PercentDeadBand* property).

- Attaching an item to an analog type :

  The general syntax for an item, described in Section 5, contains an *optional parameter* for stating the analog type to which it belongs, and also for informing the OFS server of its notification threshold.

  The syntax of an item with analog type is as follows :

  <item> ::= <DriverName>:<PLCAddress>!<VariableName>[@<AnalogTypeName>]

  Comment :

  The space before the @ character is optional.

  Example of the definition of an item :

  "FIP01:0.31.0!%MF330 @AnalogType".

Comments :

It is possible to have the same item twice in one group (eg : "%MF330") with and without the analog type suffix (" @AnalogType"), in order to compare the effect of the dead-banding for filtering the notifications.

It is possible to have items of different analog types in one group (ie : several analog groups referenced in one group).

6.10 Adjusting the Time-Out

The Time-out defines the maximum length of time the Server will wait for an answer from a device after sending a request. The time-out is for the device and not the medium.

On **Modbus+**, two links (**DM** or **PM**) may be established - the time-out value of one does not affect the other.

Default Time-out value for all devices may be defined with the OFS Configuration Tool (see 3.9).
This time-out may be configured dynamically, device per device using the specific item **#TimeOut** (see 6.18).

6.11 Managing the PLC Operating Mode

The PLC operating mode can be controlled using the specific item **#PLCStatus**. The modification of any PLC operating mode by the server can be enabled / disabled using the configuration tool (see 3.8).

The current operating mode of the PLC is viewed by reading the **#PLCStatus** specific item. The current operating mode of the PLC is modified by writing the **#PLCStatus** specific item.

The following values are associated with the different operating modes of the PLC :

STOP : 0 RUN : 1 (*) INIT : 2

(*) Not for Quantum

Note :

Modbus+ PLCs and Networks have Data Master (DM) or Program Master (PM) modes. To change the PLC operating mode, the PLC must be in PM mode.

6.12 Communication

- **The OFS server enables several communication media to be used simultaneously :** One client application can, for example, access a PLC via FIPWAY and another via ISAWAY.
- **The OFS server provides XWAY and MODBUS network transparency :** A client application can access PLCs in a PLC network architecture containing bridges for switching between communication media.

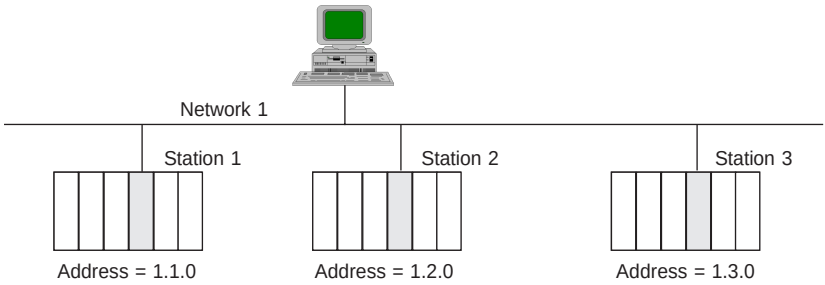
The OFS server allocates :

- **XWAY** : one socket for each medium
- **MODBUS+** : one path for each device (PM or DM)
- **MODBUS/TCP-IP** : one socket for each device

Note :

MODBUS+ paths are closed each time the last item referencing that device is removed and opened each time an item referencing that device is created.

Example for an access through a network :



- <Network>.<Station>.<Gate>.<RackModule>.<ChannelAd0>

This addressing mode is used to access a slave PLC through the master PLC.

Notes :

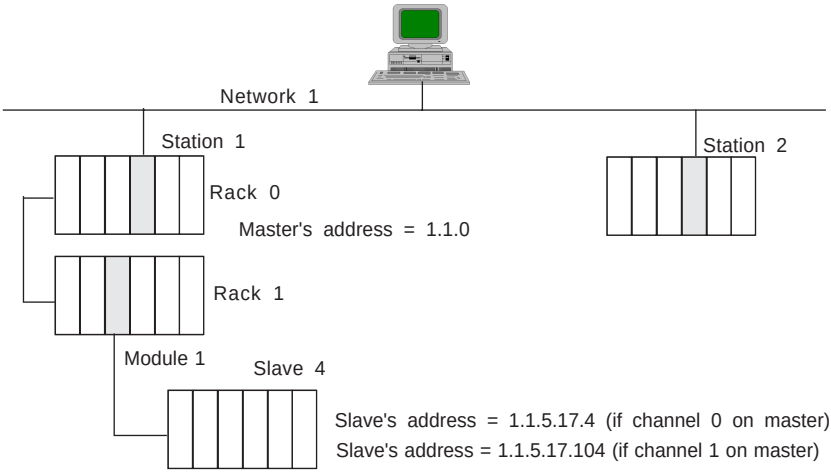
In this case, the value of the **<Gate>** field must **always** be **5**.
The <RackModule> field refers to the master PLC. Its value must be set as follows :

(Master's rack number * 16) + Master's module number.

The <ChannelAd0> field refers to the slave PLC. Its value must be set as follows :

(Master's channel number * 100) + Slave's Ad0 number.

Example :



Notes :

1. The documentation **"Reference manual of XWAY communication"** (TSX DR NET E) is the reference for the description of the XWAY addressing mode.
2. In **point to point connection** (UNI-TELWAY, ISAWAY), the **default address 0.254.0** can be used to reference the PLC.

- **MODBUS addressing modes**

  - Over TCP/IP the only information needed is the IP address. This can be given as four groups of numbers separated by dots or by a DNS name ex. “My Station”. In that case, the DNS scanning feature should be enabled (see 3.8 Misc Tab).

  - Over Modbus+ the syntax is : <access level>.<node1>.<node2>.<node3>.<node4>.<node5>

  The access level can be :

  . PM = Program Master,

  . DM = Data Master.

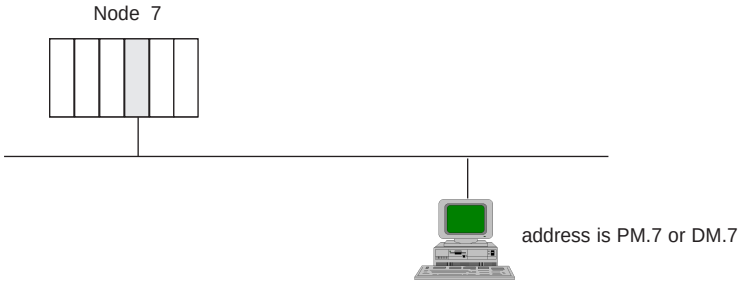
  The node number should be used to give the full path. To access a device without any bridge, only access mode and node are required.

  For TCP/IP - MODBUS+ bridges, the syntax is :

  MBT:<bridge IP address>;<Modbus+ device node number>

  If the configuration tool is used to define alias, a special dialog box « Bridge index » is displayed to enter the device node number (see 3.4).

  Example:



- **Behavior of the OFS server in the event of a communication problem with the PLC** (PLC missing, disconnected, etc) :

  - Whatever the type of communication problem, all the requests corresponding to one group will be transmitted, both in the case of a reading items and a writing items.

  - From the point of view of performance, this means that the execution period for the read or write primitive may rise to n times the time-out period (where n is the number of requests associated with the group).

  Comment :

  There is no reiteration of requests on time-out.

  Note :

  For Networks with logical connections, if the connection is broken the server automatically tries to re-establish it. Ex. Modbus TCP/IP.

The OFS server will indicate communication errors to the client application in the following way : each item belonging to a request which has failed will marked "invalid " *, whether this is for a synchronous / periodic reading of a group, or for a writing of a group.

Note (*):

Whatever method to perform the Read is used : Invalid means that the Quality attribute is bad. Valid means that the Quality attribute is good.

Comments :

• The client application can determine whether the PLC has been reconnected by readdressing a request to read (synchronous) the group concerned.

• During the periodic reading of a group, the quality of the items (*Quality* attribute) will change from *Bad* to *Good* when the PLC is *reconnected*. Section 6.17 describes the *Quality* attribute associated with an item.

6.13 Managing the Symbols

The OFS server establishes the symbol/address translation using a **symbol file**. This symbol file could have been created by a programming workshop (**Concept, Modsoft, PL7**) or with an external tool such as a Text Editor (**CSV format**).

The supported symbol file formats are :

- PL7 exported symbol table file (default extension **SCY**),
- PL7 exported application file (default extension **FEF**),
- Concept exported symbol table file (default extension **CCN**),
- Modsoft exported symbol table file (default extension **TXT**),
- CSV symbol table file (default extension **CSV**).

For each format, only symbols that are associated with enough information for accessing variables are loaded and can be used (see below for details).

The symbol/address translation can also use Concept Project File (see 6.16).

The same symbol table file can be associated with many devices or groups.

The link between the symbol file and a group of items is established either :

- By creating a link between a Device and a Symbol Table. To do that, use the Configuration Tool :

  - Create an extension for the format you intend to use (ex. .txt for Modsoft format),

  - Create an alias for the device with the Configuration Tool,

  - Link your Symbol Table with that Device.

- When the **group** is **created** by giving the name of the Symbol Table

  Ex. Create Group1 = C:\test.csv

Note :

In any case the extension should have been configured before use (see 3.3).

The management of the symbols applies to a user group. Syntax of the name of a group : **<group name>**[**=<path of Symbol Table file>**]

The OFS server indicates an error to the client application if, when establishing this link, it detects that the Symbol Table file does not exist or that it is invalid (its contents are syntactically incorrect).

If a symbol file contains "clashes" (multiple declarations of one symbol or address) the OFS server only retains the 1st occurrence of this identifier, and does not take following occurrences into account.

For example, if a symbol file contains the following associations :

- "PUMP" associated with"%MW0",
- "PUMP" associated with "%MW1".

The OFS server will consider that the symbol “PUMP” corresponds to %MW0 only. This example corresponds to an incorrect file.

Note :

The use of symbols has **no effect** on the **performance** of the services for reading and writing OFS server variables. The only difference in performance concerns the phase for creating the group : the creation of a group of symbols is in fact longer, as it includes the translation of the symbols into addresses when creating the items in the group (AddItems primitive).

6.13-1 PL7 exported symbol table file

To create such a file using the PL7 workshop :

- Open your application with PL7,
- Open the application browser,
- Open the data editor,
- Open any window of this editor (ex Memory Objects),
- Use the menu **File->Export** to create the file.

This exported file allows the consistency check (Application Name & Version) between the symbol table file and the application running into the PLC (see 3.3).

6.13-2 PL7 exported application file

To create such a file using the PL7 workshop :

- Open your application with PL7,
- Use the menu **File->Export Application** to create the file.

This exported file allows the consistency check (Application Name & Version) between the symbol table file and the application running in the PLC (see 3.3). The OFS doesn’t use the configuration information of that file.

6.13-3 Concept exported symbol table file

To create such a file using the Concept workshop :

- Open your application with Concept,
- Use the menu File->Export,
- Select either **Variables : text delimited** or **Program : IEC text,**
- Do not select any section,
- Create the file with the appropriate extension (see 3.3).

The two other choices in the menu File-Export (**Variables : Factory Link** & **Variables : Modlink**) should be avoided.

This exported file allows the consistency check (Application Name & Version) between the symbol table file and the application running in the PLC (cf 3.3).

Only located variables access is possible using this kind of file since the necessary information for accessing unlocated variables is not present. No structured variable access is possible for the same reason. All those kinds of symbols are ignored.

6.13-4 Modsoft exported symbol file

To create the application symbol file using the Modsoft workshop :

- Open your application with Modsoft,
- From the main command menu select “Utility”->”Symbol Table” to open the symbol table editor,
- Use the menu selection “File I/O”->”Export” to create the file.

This exported file doesn’t allow the consistency check (Application Name & Version) between the symbol table file and the application running in the PLC (refer to section 3.3).

Modsoft applications may be commented by using the comment section of the file. However, the OFS server only uses the reference symbols.

Only symbols compliant to the IEC format are supported. Symbols defined for the bits extracted from registers are NOT supported; all symbols of that kind are ignored as well as all symbols not IEC compliant.

6.13-5 CSV symbol table file

This kind of file can be created by tools such as Text Editors (ex Notepad) or other tools (eg. Excel 97).

The format of each line is very simple :

<Address><Separator><Symbol><Separator><Comment>

- The <Address> should be a valid address for the device associated with that symbol table file,
- The <Separator> can be either a comma, a space or a tab character,
- The <Symbol> can be any string without any comma/space/tab/special character in it.

If some special features are to be used (array length, special postifix such as R), add them to address.

Example : **400001:10;R Array_Status**
Example of array with 10 registers Read/Only

This file doesn't allow the consistency check (Application Name & Version) between the symbol table file and the application running in the PLC (see 3.3). If you plan to use Excel 97 use the comma as the separator.

6.14 Browse support

Symbol browsing is supported by the IOPC Browser Server Address Space interface. It has a Multi-level hierarchy :

One node for each device declared in the registry (Alias, Path, Symbol Table) whether or not that device is really connected.

For each node :

- A sub-folder called **"#Specific**" for all specific items that can be created for this device,
- A sub-folder for each structured variable or array (Concept project file only) that has in turn a sub-folder if the structure contains arrays or sub-structures.
- The full **list of application symbols** declared in the symbol table file associated with the device (see section 3.4) or **nothing (no symbol)** if no symbol table was declared for that device.

Devices that are **connected** but that have **not** been **configured into the Alias table** can **not be browsed.**

Filter capability is supported, enabling the user to apply type filter (for example, asking for all the boolean variables), name filter (wildcard * supported), access rights, located or unlocated (Concept proejct file only), structured or not.

It also possible to get with **each symbol** the associated **address** and the associated **comment** (filter "&a" for address and "&c" for comment or both "&a&c").

It is also possible to filter variables base on their address.

Summary of the filter syntax (BNF syntax) :

<Symbol filter>[=<Address Filter>][&A][&C].

- <Symbol filter> : any symbol string including the * wildcard,
- <Address filter> : any address string including the * wildcard,
- &A : ask for the display of the address,
- &C : ask for the display of the comment.

Examples of filters :

T*	Ask for all symbols starting with T
B* &C	Ask for all symbols starting with B and also ask for the associated comment (if any)
* =%UL	Concept project file : ask for unlocated variables only
* =%MW1*	Ask for all variables with addresses starting by %MW1
T* =%MX* &A&C	Ask for all symbols starting with T and with address starting by %MX and ask for the display of both Address and Comment

In order to speed up the Browse interface (some software packages request the opening of all available Symbol Tables when they open the Browse interface) it is possible to **preload** a Symbol Table when the server is started. This option should be selected with the Configuration Tool when creating an Alias (see 3.4).

6.15 Managing Standard PL7 Function Blocks

Reminder :

> It is only possible to **modify** the R/W fields of a **Standard Function Block** (eg :"Preset" field of a Monostable %MNi.P) if this Function Block has the **"adjustable" property**. The "adjustable" or "non adjustable" property is assigned in the Configuration editor of the PL7 workshop.

On a call to write R/W field of a standard function block, the OFS server does not perform the preliminary check to ensure that this object has the "adjustable" property. This means that if the Function Block does not have this property, the OFS server sends back the generic error code for this item which corresponds to the failure of a write request.

6.16 Concept Link Support

Using Concept Link is only possible with Concept 2.1 or later.

Each time you **reinstall** the **Concept** product, you should **reinstall** the **OFS** product just after.

The **Concept** workshop and your **.prj** files should be **located** on the **same machine**.

Using the same project with **Concept** workshop and **OFS** at the same time is possible provided that Concept is running in its own memory space (it is a 16 bit program) :

- edit your usual Concept shortcut properties,
- in the Shortcut tab, check the "Run in Separate Memory Space" check box.

To use the Concept Link, all you have to do is to specify your .prj project file (see section 3.4 or 6.13) as a symbol table file for any device or group.

Using more than one Concept project at a time with OFS is possible. All you have to do is to create the necessary alias and, for each one, specify a different .prj file

This prj file allows the consistency check (Application Name & Version) between the symbol table file and the application running in the PLC (see 3.3).

6.17 Error Handling

6.17-1 Error Feedback Mechanism

- **The error feedback mechanism is in 3 parts** :

  - The description of the result of the call (execution) of a primitive,

  - The description of the validity of an item : *Quality* flag,

  - The availability of a ***GetErrorString*** primitive responsible for feeding back the text describing an error based on its code (see Section 7.2-13) .

- **Description of the result of calling a primitive** :

  - For **all** primitives exposed, of any type (procedure or function), the result of the call is indicated to the caller using an **"exception"**, in accordance with the characteristics of the exception management specific to each language, in particular with respect to the behavior for a correct result.

  This means in particular that an error detected for a "function" type primitive is not indicated to the caller by means of the value which it returns.

  Exceptions which can be triggered are standard exceptions :

  - ***E_xxx*** errors : standard exceptions defined by OLE and Win 32,
  - ***OPC_E_xxx*** errors : exceptions specific to OPC,
  - ***EOL_E_xxx*** errors : exceptions specific to the OFS server,
  - ***OFS_E_xxx*** errors : exceptions specific to the OFS server.

  - In addition to the operation described above, some of the primitives exposed contain a ***pErrors*** parameter in their call interface (output parameter).

  This *pErrors* parameter is defined for those primitives which can handle several items in one call (example, *AddItems).* It is used to :

  - record a report for each item (an element in the *pErrors* table),

  - indicate an error to the caller by a method other than the triggering of exceptions. Typically when S_FALSE is sent back, there is no triggering of exceptions, since the result of the primitive is of the success with warning type. The *pErrors* parameter must be viewed to determine on which item the error occurred.

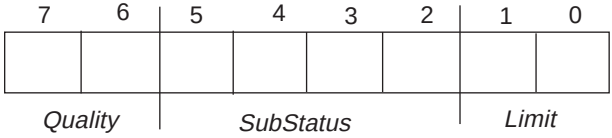
  The *pErrors* parameter is used, for example, to indicate for the *AddItems* primitive that some of the items mentioned have an invalid syntax.

- **Description of the validity of an item** :

  - The synchronous and periodic read primitives contain a ***pQualities*** parameter which describes the validity of the items concerned. They give a *Quality* attribute for each item.

  For these primitives, this parameter is in addition to the *pErrors* parameter.

  - The *Quality* attribute of an item is a value on 8 bits comprising 3 fields *: Quality, SubStatus and Limit.*



To obtain the error code which corresponds to the field concerned the relevant extraction mask must be applied and the value obtained in this way considered.

- The *Quality* field (2 bits) which gives the validity of the value of an item :

0	**Bad**	The value of the item is incorrect for the reasons given in the *Substatus* field
3	**Good**	The value of the item is correct

- The *SubStatus* field (4 bits) which gives more detailed information on the *Quality* field, and whose meaning varies according to the value (*Good*, *Bad*) of the *Quality* field.

- ***SubStatus*** field for the value ***Bad*** in the *Quality* field :

0	**Non-specific** various causes	Incorrect value with no specific reason :
6	**Comm Failure**	Incorrect value due to a problem communicating with the PLC

- ***SubStatus*** field for the value ***Good*** in the *Quality* field :

0	**Non-specific**	Correct value. No special conditions

- The *Limit* field (2 bits) is not managed.

Note :

All the other values which are not mentioned in the above tables are not significant.

The table below summarizes the error feedback mechanism used by each of the primitives exposed by the OFS server.

Primitive name	Error feedback mechanism		
	OLE / OPC exceptions	**pError attrib. per item**	**Quality attrib. per item**
MajorVersion	X		
MinorVersion	X		
BuildNumber	X		
StartTime	X		
AddGroup	X		
RemoveGroup	X		
AddItems	X	X	
ActiveStatus	X		
PercentDeadBand	X		
OPCRead	X	X	X
OPCWrite	X	X	
AddCallbackReference	X		
DropCallbackReference	X		
OnDataChange (coded in the client application)			X

6.17-2 Objects Outside the Software Configuration

The OFS server does not have access to the software configuration of the applications which it accesses.

If a group contains items which are outside the software configuration of the application in the PLC, the operation to read the group may fail on other items, which are compatible with the configuration, due to the fact that optimization algorithms are used in the read requests.

If the incorrect item is in a table, the OFS server sets the whole table to error, even if only one subset of its elements is outside the configuration.

Example :

Application in which 522 words have been configured : from %MW0 to %MW521.

The reading or writing of a group containing table item %MW520:10 will send back an error for the whole of this item, even though words %MW520 and %MW521 are in the configuration.

Note :

Words %MW520 and %MW521 in this example can be accessed individually.

6.18 Specific Items

A specific item is an OPC item not related to any PLC variable but is a way to view/ modify some internal parameters (internal to the OPC server or internal to the PLC).

- A specific item has a path like any other item.
- The definition of a specific item always starts with a '#' character.
- A specific item can be created in any group
- A specific item can NOT be in the active state even in an active group, thus no automatic change detection can be made by the server
- Specific items can be read / written within any subset of the group (including both ordinary and specific items).
- To read or write a specific item either the synchronous or asynchronous functions can be used
- Specific items available for a device can be browsed in the sub-folder "**#Specific**" attached to any device.

Note :

All specific items are disabled if the **OPC Extensions** is not checked in the Misc tab of the configuration tool (see 3.7).

"#**PlcStatus"**

This item type is VT_I2 (16 bit WORD).

This item is READ/WRITE or READ only, depending on the **Change PLC Status** option status in the Misc tab of the configuration tool (see 3.7).

Its value is the mode of the PLC (1 if PLC is running, 0 if PLC is stopped).

"#**TimeOut"**

This item type is VT_I2 (16 bits WORD).

This item is READ/WRITE.

Its value (expressed in ms) is related only to one device (defined by its path). This value represents the time the server will wait for an answer from the device after it has sent a request. Any write will modify the server internal parameter for this device.

"#NbrMaxPendingReq"

This item type is VT_I2 (WORD).

This item is READ/WRITE.

Read/Write of the MaxPendingReq parameter for a given device. This parameter is the number of requests that can be queued up to this device before setting overflow state. This item is useful only for MODBUS/TCP-IP devices.

"#**NbrRequest"**

This item type is VT_I2 (WORD).

This item is READ only.

Its value (a number of requests) is related only to one device (defined by its path). It indicates the number of requests sent to that device, by the server, to refresh its internal cache. It includes all the frequencies that may exist in the server.

This item can be created with no path within a synchro group (name starting with $ or $$ see 6.3). In that case its value is the number of requests necessary to read the whole group.

"#RefreshDevice"

This item type is VT_I2 (WORD).

This item is READ/WRITE.

This item is designed to manage the consistency between the symbol table file and the application running in the PLC.

If the value 1 is written to this item, the server will read Application Name and Application Version from the Device.

If this item is read, the server will perform a consistency check between the Application Name and Version already read from the device and the same information from the symbol table file open for that device. The value returned can be :

- 0 : No check was performed (no symbol table information or device information),
- 1 : Everything is OK and consistent,
- 2 : Application names are not consistent,
- 3 : Application versions are not consistent.

"#AppliName"

This item type is VT_BSTR (String).

This item is READ/ONLY.

It gives you the application name (if any) read from the device.

“#AppliVersion”

This item type is VT_BSTR (String).

This item is READ/ONLY.

It gives you the application version (if any) read from the device.

7.1 OPC custom

The OPC custom interface of the OFS product is compliant with the 1.01A revision.

The OPC specification document is included on the OFS CD-ROM (DOC\OPC1.01A). This documentation can be downloaded from the OPC Foundation web site : **www.opcfoundation.org**

It is beyond the scope of this documentation to teach you the direct use of this interface.

Please refer to any OPC tutorial you may find or buy. An very brief example of use is given on the CD-ROM and some explanations of this source code are given, please see 9.2.

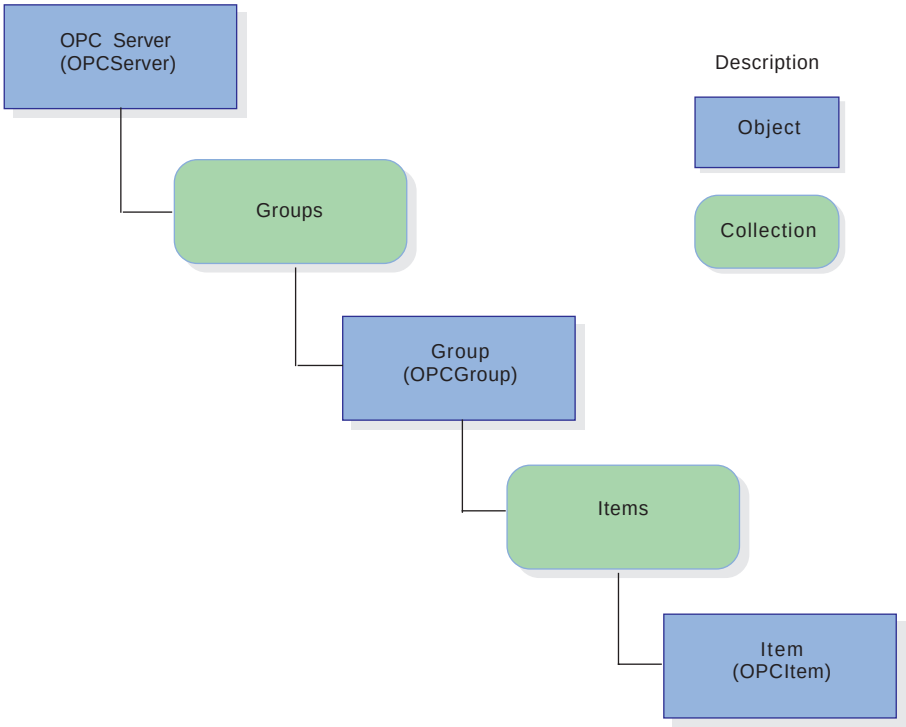
7.2 Description of the OLE Automation Interface Exposed

The OFS server is compliant with the OPC standard, version 1.1.

For these primitives, the OFS server complies with the OPC standard :

- Same hierarchy of objects.
- Same names, same call prototypes (types of parameters and type of result).
- Same mechanism for feeding back errors to the client application.

Object model of the OLE Automation interface of an OPC 1.1 server



Object model of the OPC 1.OA, OLE Automation interface used by the OFS server :

Object	OLE Automation Interface	Primitives Exposed	Description
OPCServer	IOPCServerDisp	MajorVersion MinorVersion BuildNumber StartTime	Obtain information on the OFS server.
	IOPCServerDisp	AddGroup RemoveGroup GetErrorString	Manage the collection of the groups; add/remove groups. Obtains an error message.
OPCGroup	IOPCItemMgtDisp	AddItems	Manages the collection of the items; adds items.
	IOPCSyncIODisp	OPCRead OPCWrite	Synchronous read and write group of items.
	IOPCGroupStateMgtDisp	ActiveStatus PercentDeadBand	Manages the notifiable attribute of a group of items. Manages the dead-banding associated with a group.
	IOPCAsyncIODisp	AddcallBackReference DropcallBackReference OPCRead OPCWrite	Associate a "WakeUp" function with group of items. Asynchronous Read and write group of items.
OPCItem	Obtain information on the ITEM.		

7.2-1 Error Codes

Only the most important error codes are documented for each of the primitives described in the following sections. For an exhaustive list, see Section 7.7.

This appendix is a representation of the 4 error declaration files provided by the OFS product :

- OpcError.h and OfsErr.h for **C++** language,
- OpcError.bas and OfsErr.bas for **Visual Basic** language.

7.2-2 CreateObject : Creating the OFS Server in Visual Basic

To instantiate the OFS server, a name object must be created :

"Schneider-Aut.OFSAut".

The client application must be programmed in ***early binding*** mode, which means that the link with the OFS server is made at **compilation**.

To do this, the interfaces exposed by the OFS server must have been previously registered in Visual Basic.

This operation is performed in the following way under Visual Basic 5.0 :

- Menu “Tools” | “References...”
- Check the **OPCDisp** checkbox which appears after having referenced **OFSAuto.dll**. The DLL OFSAuto.dll contains the OFS.TLB *"Type Library"* which describes all the interfaces exposed by the OFS server.

Example :

```
Const progID$ = "Schneider-Aut.OFSAut"
Public svr As IOPCServerDisp          'object "OPC Server"

Set svr = CreateObject(progID$)       'Create the OFS OPC Server
```

Exceptions fed back :

S_OK	The primitive has been executed (**S**)uccessfully.
E_OUTOFMEMORY	Insufficient memory
E_FAIL	Failure of the primitive

Removal :

To disconnect at the end of the session, remove the 'OPC server' object using the instruction :

```
Set svr = Nothing
```

7.2-3 AddGroup : Creating a Group of Items

A new group of items is created using the ***AddGroup*** primitive. The *AddGroup* primitive is exposed by the ***IOPCServerDisp*** interface of the ***OPCServer*** object.

AddGroup primitive type : function.

The parameters of the *AddGroup* primitive have the following meanings :

No.	Direct.	Parameter name	VB type	Description
1	in	*Name*	string	Name of the group to be created.
2	in	*Active*	boolean	Must systematically be at "FALSE" as the group must be created to be inactive with respect to the notification mechanism (periodic reading). Note : It is not advisable to activate notification on an empty group.
3	in	*RequestedUpdateRate*	long	Scanning period requested for the group, expressed in ms. This parameter is used for periodic reading when the group is active. See *pRevisedUpdateRate* for the actual period applied.
4	in	*ClientGroupHandle*	long	Handle assigned to the group by the client application. This handle will be fed back by the server on the activation of OnDataChange (notification).
5	in	*pPercentDeadBand*	single	Dead-banding assigned to the group. This parameter is used for periodic reading, when the group is active. Dead-banding is only managed for "floating point" variables. The expected value is a "floating point" value, which must be between 0.0 and 1.0. The use of dead-banding is described in Section 4.7.
6	in	*LCID*	long	Parameter not used by the server. Assign the value 0 to this parameter.
7	out	*pServerGroupHandle*	long	Handle assigned to the group by the server. This handle will subsequently be used to designate the group when calling primitives which operate on groups, for example the *RemoveGroup* primitive.

No.	Direct.	Parameter name	VB type	Description
8	out	*pRevisedUpdateRate*	long	Scanning period obtained for the group, expressed in ms. This parameter adjusts the periodic reading period for the group. If *RequestedUpdateRate < 3 x Xway receive rate,* the server forces *pRevisedUpdateRate* to*3 x Xway receive rate*
9	in	*pTimeBias*		Optional parameter, not used.
ret	out	*ppDisp*	object	Pointer on the IDispatch interface of the *OPCGroup* object created.

Note on the 1st parameter, *"Name"* :

The syntax of this parameter is as follows :

• For a *user* group :

"[<GroupName>][=<NeutralFileName>]"

The name of the group and the name of the Symbol Table (ST) associated with the group are optional.

Examples :

"GRP_ENGINE"	*'Group with no addresses/ 'symbols association*
"GRP_ENGINE=e:\export\symb.scy"	*'Group with a Symbol Table file*
"=e:\export\symb.scy"	*'Group with no name with a 'Symbol Table file*
"GRP_ENGINE=symb.scy"	*'Symbol Table file in the default 'directory (*)*
"GRP_ENGINE=F:\remote\dcom.scy"	*'Localization in the authorized 'network.* 'example F: points to_ "\\client\path"

Counter example :

"GRP_ENGINE=\\client\path\remote\dcom.scy"
'UNC localization in NON authorized network.

Symbol Table files can be chosen using the Coifiguration Tool

The path can have an optional back-slash at the end.
Symbols = "e:\export\pl7sec\"

• For a *system* group (dedicated to a medium and a PLC) :

"_SYS=<DriverName>:<PLCAddress>"

The name of the group is compulsory and has a fixed syntax : the prefix "_SYS=" is added.
No neutral file can be associated with a system group.

Note on the 2nd parameter, *"Active"* :

After creating at least one item, it is possible to modify the status of the *"Active"* attribute of a group using the ***ActiveStatus*** property.

The *"Active"* attribute of a group defines whether notification is operational :

If the group is **active**, **periodic reading** is triggered as soon as the group subscribes to the notification service. The "read polling" and notification of changes of values are then handled by the OFS server.

Note on the value fed back :

The pointer on the IDispatch interface of the *OPCGroup* object should be used to call up the interface which exposes the primitive to be applied to the group which has been created :

- *IOPCItemMgtDisp* interface / *AddItems* primitive to create items in the group
- *IOPCSyncIODisp* interface / *OPCRead* primitive to read the items in the group

Example :

```
Dim group As Object              ' OPC Group.
Set group = svr.AddGroup         (nameNewGroup$, False, rateRequested, _
                                 grpHndCounter, 1, 0, ServerGroupHandle, _
                                 rateRevised)
group.AddItems                   (nbrItems, ItemsDef, ItemsActivity, _
                                 tabItemslocdlClient, itemsErrors, _
                                 ItemsObject, acesspath)
```

Exceptions fed back by the AddGroup primitive :

S_OK	The primitive has been executed (**S**)uccessfully.
EOL_E_INVALID_ARG1toARG9	ARGument N is invalid.
E_OUTOFMEMORY	Insufficient memory.
E_FAIL	Failure of the primitive.
EOL_E_MISSING_NEUTRAL_FILE	The Symbol Table file defining the symbols is missing.
EOL_E_INVALID_SYMBOLS_FILE	The content of the Symbol Table file is invalid.
EOL_E_OPEN_SYMBOLS_FAILURE	Failure opening the Symbol Table file : invalid name or path, file does not exist, etc.
EOL_E_ERRORS_IN_SYMBOLS_FILE	TheSymbol Table file contains errors : syntax error on a line describing an address / symbol association, address or symbol clash.

7.2-4 RemoveGroup : Removing a Group of Items

A group of items is removed using the ***RemoveGroup*** primitive. The *RemoveGroup* primitive is exposed via the ***IOPCServerDisp*** interface of the ***OPCServer*** object.

RemoveGroup primitive type : procedure.

The parameters of the *RemoveGroup* primitive have the following meanings :

No.	Direct.	Parameter name	VB type	Description
1	in	*ServerGroupHandle*	long	Handle assigned to the group by the server (sent back by AddGroup).
2	in	*Force*	boolean	FALSE if logical deletion.

Note on the 2nd parameter, *"Force"* :

The **FALSE** value causes a **logical deletion** of the group, which means that :

• Primitives which are applied to this group subsequently will fail : *OPCRead*, *ActiveStatus*, etc.

• The group will be effectively removed when all the interfaces concerned with the group are removed.

The TRUE value forces the removal of the group.

Exceptions fed back by the RemoveGroup primitive :

S_OK	The primitive has been executed (**S**)uccessfully.
EOL_E_INVALID_ARG1 to ARG2	ARGument N is invalid.
E_OUTOFMEMORY	Insufficient memory.
E_FAIL	Failure of the primitive.

7.2-5 AddItems : Adding Items to a Group

New items are created in a group using the ***AddItems*** primitive. The *AddItems* primitive is exposed via the ***IOPCItemMgtDisp*** interface of the ***OPCGroup*** object.

Note :

This primitive is used to create one or more items in a group.

AddItems primitive type : procedure.

The parameters of the *AddItems* primitive have the following meanings :

No.	Direct.	Parameter name	VB type	Description
1	in	*NumItems*	long	Number of items to be added in the group.
2	in	*ItemIDs()*	string	Table of identifiers of the items to be created.
3	in	*ActivateStates()*	boolean	Table indicating for each new item whether it should be added to the group in "active" or "inactive" state.
4	in	*ClientHandles()*	long	Table of the handles assigned by the client application to each item to be added in the group. These handles will be fed back via the server on activation of OnDataChange (notification), so that the client application can recognize those items whose value has changed.
5	out	*pServerHandles*	variant	Table of the handles assigned by the server to each of the items added to the group. These identifiers will be used subsequently to designate the items created when the primitives which operate on the items in a group are called, for example the *OPCRead* primitive.
6	out	*pErrors*	variant	HResult table (1 per item) indicating the result of the operation for each item to be created : S_OK or code of the error detected. Two functions which are used to test the result for each item are defined in the Visual Basic tutorial (MAIN.FRM file) : • SUCCEEDED() sends back TRUE if the item has been added to the group. • FAILED() sends back TRUE if it has *not* been possible to add it to the group.

No.	Direct.	Parameter name	VB type	Description
7	out	*pItemObjects*	variant	Table of *OPCItem* objects (one for each item added to the group). Reminder : the OPCItem object of the OPC standard is neither documented, nor supported.
8	in	*AccessPaths()*	string	Must contain a table of empty strings.
9	in	*RequestedDataTypes*		Optional parameter which is not supported.
10	in/out	*pBlobs*		Optional parameter which is not supported.
11	out	*pCanonicalDataTypes*		Optional parameter which is not supported.
12	out	*pAccessRights*		Optional parameter which is not supported.

Notes on the 2nd parameter, *"ItemIDS"* :

The syntax of a table element is as follows :

- For items corresponding to PLC variables ("user group") :

  "<***DriverName***>:<***PLCAddress***>!<***VariableIdentification***>"

  <***DriverName***>: name of the driver associated with a communication medium

  <***PLCAddress***>: address of the PLC on the communication medium.

  Comment :

  See Section 5 for a description of the addressing mode.

  <***VariableIdentification***>: address or symbol of the item to be added to the group.

  Examples :

  "FIP01**:**0.31.0**!**PUMP"
  "UNTLW01**:**0.254.0**!**%MW2:10"

- For specific items in a *user* group or a *system* group :

  "#<*SpecificItemName*>"

  - in a *user* group : "*#NbrRequest*"
  - in a *system* group : "*#PLCStatus*", "*#TimeOut*"

Example of adding several items in a single call to the ***AddItems*** primitive :

```
Dim ItemsIDs (2) as string          ' Table of names of items
ItemsIDs (0)="FIP01:0.31.0!%MW0"
ItemsIDs (1)="FIP01:0.31.0!%MW1"
AddItems(2,ItemsIDs,...)
```

Exceptions fed back by the *AddItems* primitive :

S_OK	The primitive has been executed (**S**)uccessfully.
S_FALSE	(**S**)uccess status, but with at least one error on an item reported in ***pErrors*** (incorrect item index).
EOL_E_INVALID_ARG1 to ARG12	ARGument N is invalid.
E_OUTOFMEMORY	Insufficient memory.
E_FAIL	Failure of the primitive.

Most significant error values sent back in the ***pErrors*** parameter :

EOL_**S**_INVALID_APPLI_NAME EOL_**S**_INVALID_APPLI_VERSION	The application in the PLC has a different name or version number from that which is described in the Symbol Table file. This is a non-blocking (**S**)uccess report.
OPC_E_INVALIDITEMID	The syntax of the item is not what was expected.
OPC_E_UNKNOWNPATH	Unknown PLC network driver.
EOL_E_INVALID_TYPE	Unknown item type.
EOL_E_INVALID_PLC_RANGE	PLC range not supported.
EOL_E_OPEN_DRIVER_FAILURE	Failure when opening the communication driver.
EOL_E_OPEN_SOCKET_FAILURE	Failure when allocating a new communication channel to the given PLC.
EOL_E_TIMEOUT_ON_CONNECTION	Cannot establish the connection with the given PLC : error on time-out.
EOL_E_INVALID_PLC_ADDRESS	Incorrect address given for the PLC.
EOL_E_INVALID_SYMBOL	Unknown symbol for the item.
EOL_E_SYNTAX_ERROR	Syntax error in the item identifier.
EOL_E_ONLY_ONE_REQUEST	Addition of the item refused as the SINGLE REQUEST group could not be transcribed on a single request.

Comment :

The HResults : **S**_OK, **S**_FALSE, EOL_**S**_INVALID_APPLI_NAME, etc, contain the letter (**S**)uccess. If the SUCCEEDED() function is applied to these results, it will send back TRUE. Conversely, HResults containing the letter (**E**)rror cause TRUE to be sent back to the FAILED() function.

These 2 functions are defined in the MAIN.FRM file in the Visual Basic tutorial.

7.2-6 OPCRead : Reading the Items in a Group

The items in a group are read synchronously using the ***OPCRead*** primitive. The *OPCRead* primitive is exposed by the ***IOPCSyncIODisp*** interface of the ***OPCGroup*** object.

OPCRead primitive type : procedure.

The parameters of the *OPCRead* primitive have the following meanings :

No.	Direct.	Parameter name	VB type	Description
1	in	*Source*	integer	Source of the reading of these items (device or cache). OPC_DS_DEVICE or OPC_DS_CACHE
2	in	*NumItems*	long	Number of items in the group which are to be read.
3	in	*ServerHandles()*	long	Table of the handles of the items in the group which are to be read. These handles are those assigned to the items by the OFS server when they were added to the group (*AddItems* primitive).
4	out	*pValues*	variant	Table of the values obtained for the items.
5	out	*pQualities*	variant	Table of validity of the items read (1 per item).
6	out	*pTimeStamps*	variant	Table of the dates of reading the items read (1 per item). Note : This is the time-stamping when the item is read by the server and not a PLC time-stamping.
7	out	*pErrors*	variant	HResult table (1 per item) indicating the result of the operation for each item to be read : S_OK or code of the detected error.

Reminder :

The synchronous and independent reading of the status ("active" or "inactive") of the group : it is possible to perform a synchronous read operation when a group is being read periodically.

Notes on the 1st parameter, *"Source"* :

The MAIN.FRM file in the Visual Basic tutorial gives an example of the declaration of the OPC_DS_DEVICE constant :

```
' OPC constants: ref. OPC Foundation Task Force
Public Const OPC_DS_DEVICE = 2        ' Read physically the DEVICE
                                      ' (and not _the cache).
```

Notes on the 4th parameter, *"pValues"* :

Viewing the PLC operating mode (reading *#PLCStatus* item of a system group) sends back one of the following three values :

STOP : 0 RUN : 1

Exceptions fed back by the *OPCRead* primitive :

S_OK	The primitive has been executed (**S**)uccessfully.
S_FALSE	(**S**)uccess status, but with at least one error on an item reported in ***pErrors*** (incorrect item index).
EOL_E_INVALID_ARG1 to ARG7	ARGument N is invalid.
E_OUTOFMEMORY	Insufficient memory.
E_FAIL	Failure of the primitive.

Most significant error values sent back in the ***pErrors*** parameter **:**

OPC_E_INVALIDHANDLE	One or more of the handles sent is invalid.
EOL_E_INVALID_ITEMS_NBR	The number of items is incorrect.
EOL_E_INVALID_PLC_RANGE	PLC range not supported.
EOL_E_NO_APPLI_IN_PLC	No application in the PLC.
EOL_E_INSTANCE_OUT_OF_CONF EOL_E_ITEM_OUT_OF_CONF	Item outside the software configuration of the application.
EOL_E_OUT_OF_BITSARRAY_BOUNDARY	The item exceeds the limit permitted for a bit table.
EOL_E_READ_FAILURE	Failure to read the item : time-out, etc.
EOL_E_INVALID_READ_PARAMETER	Invalid item : for instance, attempt to read a grafcet macro-step on a TSX 37 or a PCX/TSX 57 which version is inferior to 3.0.
EOL_E_READ_ARRAY_FORBIDDEN	Impossible to read this kind of object with the array syntax.
EOL_E_STRING_ADDRESS_NOT_EVEN	The address (i) of a string %MBi:L must be even.
EOL_E_STRING_LENGTH_NOT_EVEN	The length (L) of a string %MBi:L must be even.
EOL_E_PLC_ALREADY_RESERVED	Viewing the PLC operating mode (reading *#PLCStatus* item) is not possible because access to this PLC is already reserved by another product.

7.2-7 ActiveStatus : Activation/Deactivation of the Periodic Reading of a Group

A group of items is **read periodically** by assigning the **"active"** status to this group : ***ActiveStatus*** property set to the value **TRUE**.

The *ActiveStatus* property is exposed by the ***IOPCGroupStateMgtDisp*** interface of the ***OPCGroup*** object.

Activation of the group has the effect of triggering the periodic scanning of the items in the group : "read polling" handled by the OFS server.

This operation requires that the group already subscribes to the notification service, so that the OFS server can subsequently indicate the items whose value has changed to the client application : calling of the **OnDataChange** "WakeUp" function.

To **stop the periodic reading** of a group of items, simply change this group to **"inactive"** status : ***ActiveStatus*** property set to value **FALSE**.

Example :

Activation of the group to trigger periodic reading :

```
group.ActiveStatus=TRUE
```

The *ActiveStatus* property is also used to view the current status of a group.

Example :

```
currentStatus=group.ActiveStatus
```

Note :

The only correct values for activating/deactivating a group are :
FALSE : 0 and TRUE : -1.

Exceptions fed back by the *ActiveStatus* property :

S_OK	The operation has been performed (**S**)uccessfully.
EOL_E_INVALID_ARG1	The ARGument is invalid : incorrect value given.
E_OUTOFMEMORY	Insufficient memory.
E_FAIL	Failure of the primitive for the operation.

7.2-8 OnDataChange : Periodic Reception of Notifications

This primitive corresponds to the "WakeUp" function by which the OFS server notifies the client application of the changes in value which have occurred on items in the groups it is scanning. This primitive is to be programmed in the client application and must be exposed by the ***IDispatch*** interface. It has a set name and call interface :

OnDataChange (GroupHandle, Count, ClientHandles (), Values (), Qualities (), GroupTime, TimeStamps())

OnDataChange primitive type : procedure.

The *OnDataChange* primitive receives the notifications for **all the groups** for which the server performs "read polling". The notification is performed **by group** and not individually for each item in a group. The *OnDataChange* primitive therefore receives the **list of items** in the group whose value has changed from one iteration to the next of the "read polling".

The parameters of the *OnDataChange* primitive have the following meanings :

No.	Direct.	Parameter name	VB type	Description
1	in	*GroupHandle*	long	Identification of the group to which the notification applies. This is the handle assigned by the client application when this group was created (AddGroup primitive).
2	in	*Count*	long	Number of items in the group whose value has changed.
3	in	*ClientHandles()*	long	Table of the handles of the items in the group whose value has changed. These are the handles assigned to these items by the client application when they were created (handles transmitted to the *AddItems* primitive).
4	in	*Values*	variant	Table of the new values of the notified items. In the case of a table item, this parameter repeats all the elements of the table, whether they have changed or not : 'Values' is a variant of variants in this case.
5	in	*Qualities*	variant	Description table of the validity of the notified items (1 per item).
6	in	*GroupTime*	variant	Time-stamping of the group by the server.
7	in	*TimeStamps*	variant	Time-stamping table of the notified items (1 per item). The time-stamping is performed by the server : this is not the PLC date / time.

Notes on the 5th parameter, *"Qualities"* :

The OFS server also notifies the client application of a **change** of the ***Quality*** attribute of an item **even if the value of that item does not change**. This enables the client application to be warned of incidents which occur during the periodic reading of a group.

Example :

The client application can monitor the status of communication with a PLC, by testing the various fields of the *Quality* attribute of the notified items (see Section 4.13-1) :

- If *Quality* is *Bad* and if *SubStatus* is *CommFailure*, this indicates that there is a connection fault with that PLC.
- If *Quality* is *Good*, this indicates that the connection with that PLC has been reestablished.

Comment :

The following constants can be defined to test the *Quality* attribute of an item (illustration in C++) :

```
#define    QUAL_BAD            0X0000
#define    QUAL_GOOD           0X00C0
#define    QUAL_COMM_FAILURE   0X0018
```

7.2-9 AddCallbackReference : Subscribing to the Notification Service

The group subscribes to the notification service using the ***AddCallbackReference*** primitive. The *AddCallbackReference* primitive is exposed by the ***IOPCAsyncIODisp*** interface of the ***OPCGroup*** object.

This operation consists of linking the group to the *OnDataChange* "WakeUp" function programmed in the client application. For a group which is to be the subject of periodic reading, it is advisable to attach this operation to the creation phase.

AddCallbackReference primitive type : function.

The parameters of the *AddCallbackReference* primitive have the following meanings :

No.	Direct.	Parameter name	VB type	Description
1	in	*Context*	long	Parameter not used by the server.
2	in	*pCallBack*	long	Address of the "WakeUp" function programmed in the client application.
ret	out	*pConnection*	long	Handle assigned to the connection by the server. This identifier will be useful for interrupting the link between the "WakeUp" function and the group of items (*DropCallbackReference* primitive).

Exceptions fed back by the *AddCallbackReferenc*e primitive :

S_OK	The primitive has been executed (**S**)uccessfully.
EOL_E_INVALID_ARG1 to ARG2	ARGument N is invalid.
E_OUTOFMEMORY	Insufficient memory.
E_FAIL	Failure of the primitive.

7.2-10 DropCallbackReference : Unsubscribing to the Notification Service

The ***DropCallbackReference*** primitive is exposed by the ***IOPCAsyncIODisp*** interface of the ***OPCGroup*** object.

It is advisable to attach this operation to the phase of removing a group.

DropCallBackReference primitive type : procedure.

The parameters of the *DropCallbackReference* primitive have the following meanings :

No.	Direct.	Parameter name	VB type	Description
1	in	*Connection*	long	Handle of the connection fed back by the *AddCallbackReference* primitive.

Exceptions fed back by the *DropCallbackReference* primitive :

S_OK	The primitive has been executed (**S**)uccessfully.
EOL_E_INVALID_ARG1	The ARGument is invalid.
E_OUTOFMEMORY	Insufficient memory.
E_FAIL	Failure of the primitive.

7.2-11 PercentDeadBand : Managing the Dead-Banding of a Group

The dead-banding value associated with a group is viewed and modified using the ***PercentDeadBand*** property. The *PercentDeadBand* property is exposed by the ***IOPCGroupStateMgtDisp*** interface of the ***OPCGroup*** object.

Notes :

- The dead-banding value mentioned indicates a percentage, and must therefore be a "floating point" value between 0.0 and 1.0.

- Assigning a new dead-banding value only affects the items in the group concerned by the definition of dead-banding (see Section 6.9).

- Dead-banding can be adjusted whatever the status ("active" or "inactive") of a group. This means that it is possible to modify the dead-banding value without interrupting the current periodic reading session.

Example :

- Modification of the dead-banding of a group :

```
group.PercentDeadBand = 0.5
```

- Viewing the dead-banding of a group :

```
Deadband = group.PercentDeadBand
```

Exceptions fed back by the *PercentDeadBand* property :

S_OK	The operation has been executed (**S**)uccessfully.
EOL_E_INVALID_ARG1	The ARGument is invalid : incorrect value given.
E_OUTOFMEMORY	Insufficient memory.
E_FAIL	Failure of the primitive for the operation.

7.2-12 OPCWrite : Writing Items in a Group

Items in a group are written using the ***OPCWrite*** primitive. The *OPCWrite* primitive is exposed by the ***IOPCSyncIODisp*** interface of the ***OPCGroup*** object.

OPCWrite primitive type : procedure.

Note :

- This primitive is used to write all or only part of the items which make up a group. Partial writing reduces the flow of requests to the PLC : only those requests corresponding to the items mentioned are transmitted.

- This primitive does not check types : it is the responsibility of the client application to check that the type of value to be written is consistent with that of the target variable.

The parameters of the *OPCWrite* primitive have the following meanings :

No.	Direct.	Parameter name	VB type	Description
1	in	*NumItems*	long	Number of items to be written.
2	in	*ServerHandles()*	long	Table of the handles of the items to be written. These are the handles assigned to these items by the server, when they were created (handles sent back by the *AddItems* primitive).
3	in	*Values()*	variant	Table of the values to be written for these items.
4	out	*pErrors*	variant	*HResult* table (1 per item) indicating the result of the operation for each item to be written : S_OK or code of the detected error.

Notes on the 3rd parameter, *"pValues"* :

To modify the PLC operating mode (write the *#PLCStatus* item of a system group) one of the following three values must be specified :

STOP : 0 RUN : 1 (*)INIT : 2

* Not for Quantum.

Exceptions fed back by the *OPCWrite* primitive :

S_OK	The primitive has been executed (**S**)uccessfully.
S_FALSE	(**S**)uccess status, but with at least one error on an item reported in ***pErrors*** (incorrect item index).
EOL_E_INVALID_ARG1 to ARG4	ARGument N is invalid.
E_OUTOFMEMORY	Insufficient memory.
E_FAIL	Failure of the primitive.

Note :

The write operation is independent of the status ("active" or "inactive") of the group : it is possible to modify the value of the items in a group which is being read periodically.

Most significant error values sent back in the ***pErrors*** parameter :

OPC_E_INVALIDHANDLE	The handle transmitted is invalid.
OPC_E_BADRIGHTS	Attempt to write an object which can be accessed in read-only.
EOL_E_INVALID_TYPE	The type of variable is invalid.
EOL_E_INVALID_ITEMS_NBR	The number of items is incorrect : value negative or greater than the number of items in the group.
EOL_E_EXPECTED_ARRAY_VALUES	A TABLE of values is expected.
EOL_E_EXPECTED_SINGLE_VALUE	A SINGLE value is expected and not a table.
EOL_E_EXPECTED_DIM1	A table with a SINGLE dimension is expected.
EOL_E_UNEXPECTED_BOUNDS	The limits of the table are invalid.
EOL_E_INVALID_PLC_RANGE	PLC range not supported.
EOL_E_NO_APPLI_IN_PLC	No application in the PLC.
EOL_E_ITEM_OUT_OF_CONF	Item outside the software configuration of the application in the PLC.
EOL_E_WRITE_FAILURE	Failure to write the item : time-out communication, attempt to write a standard function block which does not have the "adjustable" property, etc.
EOL_E_WRITE_ARRAY_FORBIDDEN	Writing this kind of table is not allowed.
EOL_E_STRING_ADDRESS_NOT_EVEN	The address (i) of a string %MBi:L must be even.
EOL_E_STRING_LENGTH_NOT_EVEN	The length (L) of a string %MBi:L must be even.
EOL_E_NO_MBi_SINGLE_ACCESS	The %MBi objects cannot be accessed individually.
EOL_E_PLC_ALREADY_RESERVED	Modifying the PLC operating mode (writing *#PLCStatus* item) is not possible because access to this PLC is already reserved by another product.

7.2-13 GetErrorString : Obtaining an Error Message

The ***GetErrorString*** primitive sends back the error message corresponding to the code for that error.

Note :

The text of this message can be obtained in the languages supported by the OFS server : English and French.

The ***GetErrorString*** primitive is exposed by the ***IOPCServerDisp*** interface of the ***OPCServer*** object.

GetErrorString primitive type : function.

The parameters of the *GetErrorString* primitive have the following meanings :

No.	Direct.	Parameter name	VB type	Description
1	in	*Error*	long	Code of the error (HResult) for which the text of the message is to be obtained.
2	in	*Locale*	long	Code of the language in which the text of the message is to be obtained. Give one of the 2 following values (hexadecimal) : French : &H409 or English : &H40C
3	ret	*ErrorString*	string	Text, in the required language, of the error message corresponding to the given error.

Exceptions fed back by the *GetErrorString* primitive :

S_OK	The primitive has been executed (**S**)uccessfully.
EOL_E_INVALID_ARG1 to ARG2	ARGument N is invalid.
E_OUTOFMEMORY	Insufficient memory.
E_FAIL	Failure of the primitive.
OPC_E_UNKNOWNLCID	The server does not support the local language code (LCID) indicated.
EOL_E_MISSING_OPCerror_DLL	The OPCerror.dll resources file cannot be loaded.
EOL_E_MISSING_EOLESerr_DLL	The OFSerr.dll resources file cannot be loaded.
EOL_E_RESOURCE_NOT_FOUND	The resources DLL has not been found.
EOL_E_MSG_NOT_FOUND	The message has not been found.

Notes on the 2nd parameter, *"Locale"* :

The MAIN.FRM file of the Visual Basic tutorial gives an example of the declaration of the constant indicating that the text of the messages should be in English :

```
const dwLangId_ENGLISH = &H409
```

7.2-14 MajorVersion : Information on the OFS Server

The following properties exposed by the ***IOPCServerDisp*** interface of the ***OPCServer*** object provide information on the OFS server :

- ***MajorVersion*** **property :**
  This property sends back an **INTEGER** indicating the value of the version index of the OFS server.
- ***MinorVersion*** **property :**
  This property sends back an **INTEGER** indicating the value of the release index of the OFS server.
- ***BuildNumber*** **property :**
  This property sends back an **INTEGER** indicating the value of the generation number of the OFS server.
- ***StartTime*** **property :**
  This property sends back a **DATE** indicating the date the OFS server was launched.
- ***CurrentTime*** **property :**
  This property sends back a **DATE** indicating the current time for the OFS server.

Note :

Regarding information about date and time, the OFS server uses the system hour (UTC.

Exceptions fed back by these properties :

S_OK	The primitive has been executed (**S**)uccessfully.
E_OUTOFMEMORY	Insufficient memory.
E_FAIL	Failure of the primitive.

8.1 Target Performance

- **Test software configuration :**

Pentium Pro 200 , 64 Mb of RAM with **NT 4.0 SP3** operating system.

- **Test scenario :**

· Reading of 100 WORDS as single items. The 100 WORDS are read with one network request.

· Variations in the PLC scan time : 40, 80, 160 ms.

· 100 calls to the SyncIO Read function : synchronous reading means the client application waits for the completion of the request each time.

· Measurement of the maximum read time (ms), minimum read time (ms) and the average read time (ms) for each medium :

- **Results of the tests :**

- PLC scan time = 40 ms

	Max time (ms)	Min time (ms)	Average time (ms)
TSX 302 FIPWAY	270	150	210
TSX 302 UNITELWAY	610	260	430
TSX 302 UNITE TCP/IP	170	60	100
QUANTUM 113/03 MB+	100	40	60
QUANTUM 113/03 TCP/IP	100	40	60
QUANTUM 424 TCP/IP	100	30	50

- PLC scan time = 80 ms

	Max time (ms)	Min time (ms)	Average time (ms)
TSX 302 FIPWAY	330	150	200
TSX 302 UNITELWAY	660	310	480
TSX 302 UNITE TCP/IP	160	50	120
QUANTUM 113/03 MB+	150	40	80
QUANTUM 113/03 TCP/IP	150	40	80
QUANTUM 424 TCP/IP	130	30	80

- PLC scan time = 160 ms

	Max time (ms)	Min time (ms)	Average time (ms)
TSX 302 FIPWAY	360	210	310
TSX 302 UNITELWAY	670	380	590
TSX 302 UNITE TCP/IP	260	60	160
QUANTUM 113/03 MB+	240	80	160
QUANTUM 113/03 TCP/IP	240	80	160
QUANTUM 424 TCP/IP	230	60	160

Comments :

- The PLC scan time is very important
- The number of network requests handled at each scan by the PLC is also important

Tuning hints :

The min update rate parameter (cf OFS Configuration tool, Misc tab) should be accurate and not set deliberately to the minimum possible value.

9.1 Tutorial on Creating a Client Application in Visual Basic

The example of a client application described in this section illustrates the use of the main functions defined by the OFS server. The example shown is for UNI-TELWAY but other protocols may be substituted. This tutorial is programmed in Visual Basic 5.0 using OLE Automation.

Notes :

This tutorial provides a programming example for a client application in its simplest form for ease of comprehension : in particular, it does not include any error handling.
For this reason, it is not recommended for use in industrial contexts :

- no reporting of status code for setting up an industrial application,
- no simultaneous execution with an industrial application.

- **Description of the tutorial**

The tutorial has been designed to communicate **on-line** with **a single PLC** and to operate with **all the communication media** handled by the OFS server.
By default it operates on UNI-TELWAY : PLC connected on the serial port (COM1 or COM2) of the station.
In this case, the PLC address is as follows : 0.254.0 (default address).
The tutorial launches the OFS server automatically if it has not already been loaded in the memory.

- **Launching the tutorial**

In the default configuration handled by the tutorial (PLC connected to the serial port of the station) the tutorial can be launched with its parameters as they have been set by the installation procedure :

"Start" | "Programs" | "Modicon Telemecanique" | "Tutorial"

To change the communication medium or the PLC address, the tutorial shortcut command line must be modified : "Target" field, "Shortcut" tab in "Properties" window.

The syntax of the command line is as follows :

<AccessPath> tutorial.exe [<DriverName>:<PLCAddress>]

If no parameter is indicated, the connection will be made on UNI-TELWAY at address 0.254.0 (default configuration).

Examples of the tutorial shortcut command line :

- tutorial.exe *' Connection on UNI-TELWAY at 0.254.0*
- tutorial.exe ISAWAY01:1.25.0 *' Connection on ISAWAY at 1.25.0*
- tutorial.exe FIP01:1.2.0 *' Connection on FIPWAY at 1.2.0*
- tutorial.exe XIP01:127.36.5.3.8 *' Connection on XWAY TCP/IP at 127.36.5.3.8*

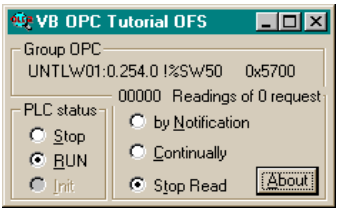
- **The functions of the tutorial**

  - When the tutorial is launched :

    · Connection to the PLC via the selected communication medium : default configuration or configuration entered in the shortcut command line.

    · Creation and reading of a **USER** group containing the "**#NbrRequest**" specific item and system word "**%SW50**" which is updated every second.

    · Creation and reading of a **SYSTEM** group containing the two specific items "**#PLCStatus**" and "**#TimeOut**".

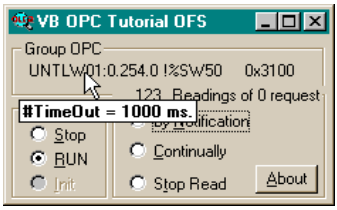


WARNING :

Initialization of the UNI-TELWAY driver may take up to 15 seconds on some stations. You must wait for the text "Group OPC" to appear in the "UNTLW01:0.254.0!%SW50" item box before performing any operation on the user interface. During this initialization phase, the mouse pointer is in the form of an hourglass.

  - In nominal mode :

    · Pointing with the mouse at the various texts in the tutorial window either shows a tool tip for the buttons, or displays information on the operation of the OFS server.



Example :

Pointing to "UNTLW01" gives the value of the communication driver time-out : reading of the "#TimeOut" specific item.

Pointing here means simply moving the mouse pointer to the text "UNTLW01".

Do not click or move the mouse for 3 seconds, until the tool tip appears.

· Activating the "About" button displays a dialog box giving :

- the version index, the release index and the generation number of the OFS server,
- the launch date and the execution time of the OFS server.

· Selecting either of the buttons Stop / RUN in the “PLC status” box changes the operating mode of the PLC : writing of the "#PLCStatus" specific item.

· Activating the "by Notification" button activates the periodic reading of the user group. The scanning period is one second.

· Activating the "Continually" button activates an infinite loop of "synchronous" readings of the user group. These are an illustration of the handling of read polling by a client application.

· Activating the "Stop Read" button stops the read operations.

- Closing the tutorial

· Activate the "Stop Read" button in order to stop all read operations,

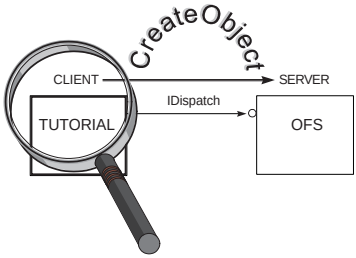
· Click on the [X] in the top right-hand corner of the tutorial window,

· Close the OFS server by clicking the right mouse button on the icon in the taskbar then selecting "Close".

9.1-1 CreateObject : Creating an OPC Server Object

Instantiating the OFS server : creation of an object with the progID
"Schneider-Aut.OFSAut" for on-line communication, or
"Schneider-Aut.OFSSimuAut" for off-line simulation

The instantiation is performed when the tutorial is launched, when the main form is loaded.




```
Const progID$ = "Schneider-Aut.OPCAut"          ' Identification of the OPC server
Public svr As IOPCServerDisp                    ' object "OPC server"

Private Sub mnuOPCconnect_Click()               ' to be connected to the OPC server
        ...
        set svr = createObject(progID$)         ' early binding mode
        ...
```

The object pointer *svr* sent back by *CreateObject* is tested to check that it is not zero using the instruction "*Is Nothing* ".

9.1-2 AddGroup : Adding a Group

Function : to create a user group or a system group.
Interface : *IOPCServerDisp*.

Definition of the network driver and the PLC address used to reference item %SW50 in the user group and in the name of the system group :

```
#If FIP Then                                        ' Conditional Compilation Arg:
Const defaultDriverPLC = "FIP01:0.31.0"             ' "FIP = 1"
#Else
Const defaultDriverPLC = "UNTLW01:0.254.0"          ' Here, we've got "FIP = 0"
#End If
Dim driverPLC$                  'Contents defaultDriverPLC if command() line is empty
```

```
Private Sub Form_Load() 'Main entry point: loading of the MAIN form.
        If Command() = "" Then                      ' Is a command line prm in the shortcut?
                driverPLC$ = defaultDriverPLC       ' Use default <driver>:<PLC address>
        Else ' The command line parameter contents "<driver>:<PLC address>"
                driverPLC$ = UCase$(Command()) ' i.e: "ISAWAY01:0.25.12"
        End If
```

When it is launched, the tutorial creates two groups :

```
Private Sub Form_Activate()                         ' Create OPC groups at the first activation.
        ...
        If Not createMainGrp() Then End             ' Create the normal OPC group.
        If Not createSystemGrp() Then End' Create the System group.
        ...
End Sub 'Form_Activate
```

- A **USER group**

```
Dim grpOpc As Object                                ' The main OPC Group.
Const hndCliGrpOpc = 1: Dim hndSrvGrpOpc As Long ' HaNDle side CLIent/SeRVer
Const dwLangId_ENGLISH = &H409
                        'MAKELANGID(LANG_ENGLISH,SUBLANG_ENGLISH_US)
```

```
Function createMainGrp() As Boolean                 ' Creation of the main OPC group.
Dim rateRevised As Long                             ' Understood Rate for periodic readings
...
Set grpOpc = svr.AddGroup("MAIN", False, 1000, hndCliGrpOpc, 1, _
                          dwLangId_ENGLISH, hndSrvGrpOpc, rateRevised)
```

- A **SYSTEM group**

```
Dim grpSys As Object                                ' The SYSTEM group.
Const hndCliGrpSys = 2: Dim hndSrvGrpSys As Long    ' HaNDle side CLIent/SeRVer
```

```
Function createSystemGrp() As Boolean               ' Create a SYSTEM group.
Dim rateDummy As Long, ItemsDef(nbrItems) As String ' Name of each item.

        createSystemGrp = False: On Error Resume Next
        Set grpSys = svr.AddGroup("_SYS=" + driverPLC$, False, 1000, _
                hndCliGrpSys, 1, dwLangId_ENGLISH, _
                hndSrvGrpSys, rateDummy)
```

9.1-3 AddItems : Adding Items in a Group

Function : to add items in a group.
Interface : *IOPCItemMgtDisp.*

Items must be added after the two groups (user and system) have been created.

- Adding the "#NbrRequest" and "%SW50" items in the user group :

```
Dim tabItmsOpcHndCli(nbrItems) As Long          ' HaNDles of ITeMS
Dim tabItmsOpcHndSrv(nbrItems) As Long          ' Handles returned by the server

Function createMainGrp() As Boolean             ' Creation of the main OPC group.
Dim ItemsDef(nbrItems) As String                ' Name of each item.
    ...
    LabelDriverPLC.Caption = driverPLC$         ' "<driver>:<PLC address>".
    LabelItem.Caption = "!%SW50"                ' Name of item prefixed with "!".
    ItemsDef(0) = LabelDriverPLC.Caption + LabelItem.Caption
    ItemsDef(1) = "#NbrRequest"                 ' Specific item NAME in this group.
    createItems grpOpc, ItemsDef(), tabItmsOpcHndCli(), tabItmsOpcHndSrv()
```

- Adding the "#PLCStatus" and "#TimeOut" items in the system group :

```
Dim tabItmsSysHndCli(nbrItems) As Long          ' Handles of items client side.
Dim tabItmsSysHndSrv(nbrItems) As Long          ' Handles of specific items

Function createSystemGrp() As Boolean           ' Create a SYSTEM group.
    ...
    ItemsDef(0) = "#PLCStatus"          ' Name of specific items in the system group.
    ItemsDef(1) = "#TimeOut"
    createItems grpSys, ItemsDef(), _
        tabItmsSysHndCli(), tabItmsSysHndSrv()
```

```
' Creation items of group: IN:ItemsDef() name of items, OUT:tabItemsHdlSrv()
Sub createItems(interfaceOfGroup As Object, ItemsDef() As String, _
        tabItemsLocHdlClient() As Long, tabItemsHdlSrv() As Long)
Dim indItem%, ptrItemMgt As IOPCItemMgtDisp     ' Management of item.
                                                ' Passing parameters to "AddItems"
Dim ItemsActivity(nbrItems) As Boolean          ' TRUE by default, items're activated
Dim tabItemsLocHdlSrv As Variant        ' OUT: handle of items
Dim itemsErrors As Variant                      ' table of error per item
Dim ItemsObject As Variant                      ' table of created items
Dim accessPath(nbrItems) As String              ' IN:  empty accessPath for each item
    For indItem% = 0 To nbrItems - 1            ' Preparing the  prms for "AddItems"
        ItemsActivity(indItem%) = True          ' Item is activated by default
        hndClientItemCounter = hndClientItemCounter + 1
        tabItemsLocHdlClient(indItem%) = hndClientItemCounter ' Client Handle
    Next
    On Error Resume Next
    Set ptrItemMgt = interfaceOfGroup
    ' Create all the OPC items for this group
    Call ptrItemMgt.AddItems(nbrItems, ItemsDef, ItemsActivity, _
                             tabItemsLocHdlClient, _
                             tabItemsLocHdlSrv, itemsErrors, _
                             ItemsObject, accessPath)   ...
    For indItem% = 0 To nbrItems - 1 ' Successfully new added items.        ...
        tabItemsHdlSrv(indItem%) = tabItemsLocHdlSrv(indItem%)
    Next
    Set ptrItemMgt = Nothing
End Sub 'createItems
```

9.1-4 OPCRead : Synchronous Reading of a Group

Read primitive used for synchronous reading of all the items in a group.
Interface : *IOPCSyncIODisp.*

The readGroup function in the tutorial performs the synchronous reading of the items. It is called in the following two cases :

- When the tutorial is launched, to perform the first read of the user group and the system group.

  - User group :

```
Function createMainGrp() As Boolean          ' Creation of the main OPC group.
...
createMainGrp = readGroup(grpOpc, _
            tabItmsOpcHndCli(), tabItmsOpcHndSrv())
End Function                                 ' createMainGrp
```

  - System group :

```
Function createSystemGrp() As Boolean        ' Create a SYSTEM group.
 ...
createSystemGrp = readGroup(grpSys, _
            tabItmsSysHndCli(), tabItmsSysHndSrv())
End Function                                 ' createSystemGrp
```

```
Function readGroup(interfaceOfGroup As Object, _
                   tabItemsLocHdlClient() As Long, tabItemsHdlSrv() As Long)
Dim numItem As Long, ptrSyncIO As IOPCSyncIODisp      ' SYNCHRonous I/O.
                                                      ' Passing parameters for OPCRead
Dim pValues As Variant                                ' OUT:  table of values of items
Dim pQualities As Variant, pTimeStamps As Variant, pErrors As Variant
        ...
        Set ptrSyncIO = interfaceOfGroup    ' Interface of  SYNCHRONOUS I/O
        Call ptrSyncIO.OPCRead(OPC_DS_DEVICE, nbrItems, tabItemsHdlSrv, _
                pValues, pQualities, pTimeStamps, pErrors)
        ...
        For numItem = LBound(pValues) To UBound(pValues)
                ...
                GUIitemDisplay pValues(numItem), (tabItemsLocHdlClient(numItem))
        Next
        Set ptrSyncIO = Nothing
        Screen.MousePointer = vbDefault: readGroup = True
End Function 'readGroup
```

- When the "Continually" button is activated for continuous reading of the user group.

```
Private Sub OptionReading_Click(Index As Integer)          ' Type of readings.
Select Case Index ...
Case chkCont:   LabelCounter.Caption = 0
        While OptionReading(chkCont).Value
        LabelCounter.Caption = LabelCounter.Caption + 1: DoEvents
        readGroup grpOpc, tabItmsOpcHndCli(), tabItmsOpcHndSrv()
        Wend
...
End Sub 'OptionReading_Click
```

9.1-5 Periodic Reading of the User Group

- **AddCallbackReference : subscription to the notification service**

  Registration of the user group with the OFS server in order to subscribe to the notification service for the changes of value of these items.
  Interface : *IOPCAsyncIODisp.*

  In the tutorial, the user group subscribes to the notification service when the group is created.

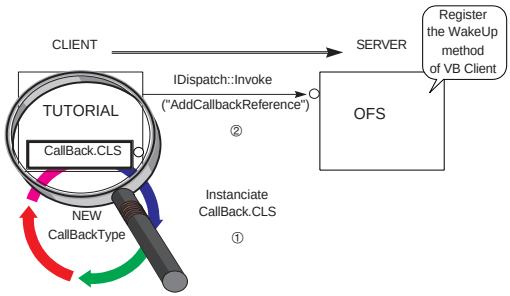
```
Dim ptrAsyncIO As IOPCAsyncIODisp                    ' Asynchronous I/O.

Function createMainGrp() As Boolean                  ' Creation of the main OPC group.
    ...
    Set grpOpc = svr.AddGroup("MAIN", False, 1000, hndCliGrpOpc, 1, _
    dwLangId_ENGLISH, hndSrvGrpOpc, rateRevised)
    ...
    Set ptrGrpStateMgt = grpOpc                      ' Used in "OptionReading_Click"
    Set VbCallBack = New callBackType                ' Create a VB callback handler
    If Err.Number <> S_OK Then warning               "1020: can't create VB callback" + _
                                                     " for the main OPC group", (Err.Number)
    " Give it to the OPC group interface
    Set ptrAsyncIO = grpOpc                          ' Get Async interface ptr
    asynchrHnd = ptrAsyncIO.AddCallbackReference(1000, VbCallBack)
    If FAILED(Err.Number) Then warning "1030: can't subscribe callback" + _
                                                     " for the main OPC group", (Err.Number)
End Function                                         ' createMainGrp
```

CallBackType corresponds to a Visual Basic ***ClassModule***, and indicates the implementation of the "WakeUp" function which is called by the notification service. This *ClassModule* is implemented in the callBack.**CLS** file in the tutorial.

The instruction "new CallBackType" creates a new handle on the "WakeUp" function : *VbCallBack*.

The *AddCallBackReference* primitive then associates this new handle with the user group, which establishes the subscription of this group to the notification service used by the OFS server.

asynchrHnd, the handle sent back by the *AddCallbackReference* primitive should be used with the *DropCallbackReference* primitive to end the notification mechanism on this group.



- **OnDataChange : receiving notifications of changes of value**

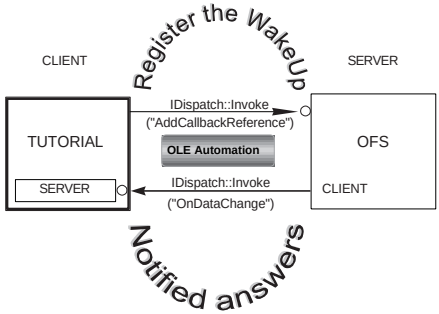
  This method corresponds to the "WakeUp" function to be programmed to receive notifications transmitted by the OFS server when items in the groups being periodically scanned change value.

  To use the "WakeUp" function in Visual Basic, the designer must create a ***ClassModule*** in the client application which he is programming.
  This *ClassModule* must expose, in a class with **suffix .CLS**, an **OnDataChange** method with the syntax below.

  Reminder :

  In the tutorial, this class is implemented in the **callBack.cls** file.

```
Public Sub OnDataChange(GroupHandle As Long, _
        countOfChangedItems As Long, _
        ClientHandles() As Long, _
        valuesItem As Variant, Qualities As Variant, _
        GroupTime As Variant, TimeStamps As Variant)
Dim indItem As Long

        MAIN.LabelCounter.Caption = MAIN.LabelCounter.Caption + 1
        For indItem = 0 To countOfChangedItems - 1 ' Display each new value
        MAIN.GUIitemDisplay valuesItem(indItem), (ClientHandles(indItem))
        Next
End Sub 'OnDataChange
```



The notification mechanism reverses the Client / Server relationship : the client application becomes the OLE Automation server to display the *OnDataChange* method to the OFS server, which itself becomes the OLE Automation Client in this case.

- **ActiveStatus : activating the group to authorize the notifications**

  Activation of the periodic reading of a user group.
  Interface *IOPCGroupStateMgtDisp.*

  In the tutorial, the periodic reading is controlled by the "by Notification" radio button.

```
Private Sub OptionReading_Click(Index As Integer)          ' Type of readings.
        Select Case Index
        Case chkNotify: LabelCounter.Caption = 0           ' The main OPC Group
                ptrGrpStateMgt.ActiveStatus = True         ' ... is activated.
        ...
        End Select
End Sub 'OptionReading_Click
```

The periodic reading is triggered as soon as the ***ActiveStatus*** property of the user group is set to the value **TRUE**.
The OFS server then uses the **scanning period** given when the group was created : 3rd parameter of the *AddGroup* primitive.
In the tutorial, this value has been set at 1000 ms.

Reminder :

> A group should never activate notification when it is created : the 2nd parameter of the *AddGroup* primitive must always be set to the value FALSE.
> It is only after an item has been created that the *ActiveStatus* property of the group can be changed to TRUE to trigger the periodic reading.

9.1-6 OPCWrite : Writing the Value of the Items in a Group

Writing items from a group in the PLC.
Interface : *IOPCSyncIODisp.*

The tutorial illustrates this function by using the writing of the "#PLCStatus" specific item of the system group.
The write operation is triggered by activating one of the radio buttons in the "PLC status" box : "Stop" or "RUN".

Note :

The tutorial program requests confirmation to the user before calling the write primitive responsible for modifying the operating mode of the PLC.

Note :

Writing items in a user group is identical to that described in this section.

```
Private Sub OptionPLCStatus_Click(Index As Integer)                    ' WRITING "#PLCStatus"
Const nbrWriteItems = 1: Dim ptrSyncIO As IOPCSyncIODisp  ' SYNCHRonous I/O.
Dim itemsValues(nbrWriteItems) As Variant, itemsErrors As Variant
    If framePLCStatus.ToolTipText = ' #PLCStatus=" + Str$(Index) Then Exit Sub
    If MsgBox("Do you want to set the PLC status to " + _
                Mid$(OptionPLCStatus(Index).Caption, 2), _
                vbQuestion Or vbOKCancel, _
                "Confirmation of PLC Status change") = vbCancel Then
        If Index = PLCrun Then Index = PLCstop Else Index = PLCrun   ' Restore
        framePLCStatus.ToolTipText = "#PLCStatus=" + Str$(Index)     ' previous
        OptionPLCStatus(Index).Value = True: Exit Sub                ' PLC status.
    End If
    On Error Resume Next
    Set ptrSyncIO = grpSys              ' SYNCHR. I/O Interface for the SYSTEM group.
    itemsValues(0) = Index              ' 0: stop, 1: run, (2: init)
    ptrSyncIO.OPCWrite nbrWriteItems, tabItmsSysHndSrv, itemsValues, _
                itemsErrors
    If FAILED(Err.Number) Then warning ' 1090: OPCWrite fails " + _
                                       ' on item #PLCStatus", (Err.Number)
    If FAILED(itemsErrors(0)) Then warning "1100: OPCWrite fails " + _
                                       ' on specific item #PLCStatus", itemsErrors(0)
    framePLCStatus.ToolTipText = "#PLCStatus=" + Str$(Index)
End Sub 'OptionPLCStatus_Click
```

9.1-7 DropCallbackReference and RemoveGroup : Closing the Tutorial

When it is closed, the tutorial program must in particular :

- Indicate to the OFS server that it no longer wishes to receive notifications on the user group : calling of the "***DropCallReference***" primitive.
  It is essential to remove the link between the "WakeUp" function and the group :
  Set VbCallBack = Nothing
- Remove the groups of items using the "***RemoveGroup***" primitive.
- Remove the interfaces to the server.

```
Private Sub Form_Unload(Cancel As Integer)          ' Shutting down of the form.
        On Error Resume Next                        ' Don't worry if it never fails.
        OptionReading_Click chkStop                 ' Disable notification
        Set VbCallBack = Nothing: ptrAsyncIO.DropCallbackReference asynchrHnd

        Set ptrAsyncIO = Nothing: Set ptrGrpStateMgt = Nothing

        Set grpOpc = Nothing: svr.RemoveGroup hndSrvGrpOpc, False
        Set grpSys = Nothing: svr.RemoveGroup hndSrvGrpSys, False


        Set svr = Nothing
End Sub 'Form_Unload
```

Note :

It is preferable to stop all read operations (continuous or periodic) before closing the client application. To do this, select the "Stop Read" radio button.

9.1-8 GetErrorString : Managing OPC, OFS and Win32 Errors

In the tutorial, error handling is centralized in the "warning" function for all the OFS server primitives which are used.

The "warning" function performs a first pass to check the type of error and for formatting, then calls the "OPCerrorString" function :

```
Sub warning(msg$, ByVal HResultErrorCode As Long)                    ' Error manager handler.
Dim txtError$
        If HResultErrorCode <> S_OK Then
                txtError$ = vbCrLf + "Error" + " 0x" + Hex(HResultErrorCode)
                Clipboard.SetText " 0x" + Hex(HResultErrorCode)     ' Ctrl+C HRESULT
                ' Get the message from VB Error Manager
                If Err.Description <> "" Then txtError$ = txtError$ + ": " + _
                                                                Err.Description
                txtError$ = txtError$ + vbCrLf
                If Err.Source <> "" Then txtError$ = txtError$ + "Object: " + _
                                                                Err.Source + vbCrLf
                txtError$ = txtError$ + OPCerrorString(HResultErrorCode) ' OPC/EOLES
        End If
        Screen.MousePointer = vbDefault
        MsgBox Mid$(msg$, 7) + txtError$, vbExclamation, _
                App.EXEName + " warning " + Left$(msg$, 4)
        Unload MAIN: End
End Sub                         ' warning
```

The "OPCerrorString" function calls "**GetErrorString**" to obtain the description of the error :

```
Function OPCerrorString(HResultErrorCode As Long) As String
Const maxErrorMsgPerLine = 50: Dim msgError$, indBlank%
        msgError$ = ""
        If Not isErrorStringFAILED Then
                On Error Resume Next
                msgError$ = svr.GetErrorString(HResultErrorCode, dwLangId_ENGLISH)
                If FAILED(Err.Number) Then
                        isErrorStringFAILED = True  " Avoid infinite recursive calls.
                        warning "1110: GetErrorString fails for HRESULT = 0x" + _
                                Hex$(HResultErrorCode), (Err.Number)
                End If
                If Len(msgError$) > maxErrorMsgPerLine Then
                        indBlank% = InStr(maxErrorMsgPerLine, msgError$, " ")
                        If indBlank% > 0 Then
                                msgError$ = Left$(msgError$, indBlank% - 1) + vbCrLf + _
                                        Space$(9) + Mid$(msgError$, indBlank% + 1)
                        End If
                End If
        End If
        OPCerrorString = msgError$
End Function ' OPCerrorString
```

9.1-9 MajorVersion : Information on the OFS Server

All the information is displayed by activating the "About" button :

About VB OPC TUTOROFS V 1.0.650 IE21
You're connected to the OPC server
Schneider-Aut.OFSAut V 1.0.653
at Wednesday, July 15, 1998 8:00:54 PM
The OPC server has been running for 00:00:06
Copyright © 1998 Schneider Automation
OK

```
Private Sub CmdAbout_Click()            'About TUTORIAL!
        MsgBox "You're connected to the OPC server" + vbCrLf + _
               progID$ + " V" + Str$(svr.MajorVersion) + "." + _
               Format$(svr.MinorVersion) + "." + Format$(svr.BuildNumber) + _
               vbCrLf + vbCrLf + "at " + _
               Format$(svr.StartTime, "dddd, mmmm d, yyyy hh:mm:ss AMPM") + _
               Format$(svr.CurrentTime - svr.StartTime, "hh:mm:ss") + vbCrLf + _
               "Copyright © 1998 Schneider Automation", _
               vbInformation Or vbOKOnly, "About VB OPC " + UCase$(App.EXEName) + _
               " V" + Str$(App.Major) + "." + Format$(App.Minor) + "." + _
               Format$(App.Revision)
End Sub                 'CmdAbout_Click
```

9.2 Tutorial on Creating a Client Application in C ++

The full source code of the example described below can be installed on your machine if you check the Tutorial option when installing the server. It is put into the **Tutorial\Mfc** sub-directory. The example client application described in this section illustrates the use of the OPC Custom Interfaces defined by the OFS server. It has been developed using Visual C++ 5.0 SP3.

Note :

The restrictions of the previous VB Tutorial apply also for the C++ Tutorial.

- **Description of the tutorial**

  The tutorial has been designed to communicate **on-line** with **a single PLC** via any protocol supported by the OFS server.

- **Launching the tutorial**

  1. "Start">"Programs">"Modicon Telemecanique">"OFS Testing Clients"> **"C++ Tutorial OFS"**,

  2. Select **"OPC Factory Server"** (on-line) or **"OPC Factory "Simulator"** (off-line) in the list box,

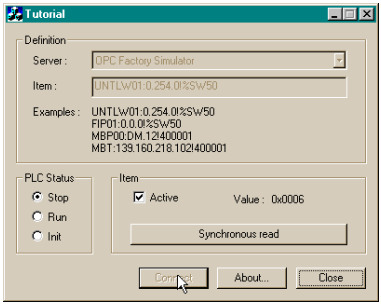
  3. Enter the the address and the definition of the Item you want to access (separated by a '!'),

  For instance :
  UNTLW01 :0.254.0 !%SW50 to access a PLC with the UNI-TELWAY protocol
  MBP00 :DM.12 !400001 to access a PLC with the Modbus+ protocol

  4. Click on the **"CONNECT**" button.

WARNING :

Initialization of the UNI-TELWAY driver may take up to 15 seconds on some stations. During this initialization phase, the mouse pointer is in the form of an hourglass.



The **"Active"** checkbox is initially checked. This means that the value of the item is displayed at each change.

If you uncheck the checkbox, you can click manually on the **“Synchronous. Read”** button to read the value of the item.

On the left side, the **“PLC Status”** frame indicates if the PLC is running. Selecting either of the **"Stop" / "Run"** option buttons changes the operating mode of the PLC, and writes to the “**#PLCStatus**” specific item.

Closing the tutorial, then the server

1. Click on the [X] in the top right-hand corner of the tutorial window,
2. Close the OFS server by clicking the right mouse button on the icon in the taskbar then selecting **"Close"**.

9.2-1 Creating an OPC Server Object

The Tutorial function that performs this operation is called **ConnectServer**.

This function uses the Microsoft **CLSIDFromProgID** API to convert the server name into an internal key (**CLSID**), then creates the connection by calling **CoCreateInstance**.

Comment :

This will start the server if it is not already running.

9.2-2 Adding a Group

The creation of the group is implemented in the **CreateGroup** method. It is based on a call to the AddGroup method of the IOPCServer interface.

9.2-3 Adding Items to a Group

The two PLC variables used in in the tutorial are added to the group in the **CreateItems** method. They are both created in a single call to the **AddItems** method of the **IOPCItemMgt** interface.

9.2-4 Synchronous Reading of a Group

The synchronous read is performed with the **IOPCSyncIO** interface. Two methods implement this solution to retrieve values from the server. The **ReadPLCStatus** method reads the state of the PLC, and **ReadItem** reads tha value of the item.

9.2-5 Periodic Reading of the User Group

When the group is active, it receives values of items that have changed. The mecanism used to subscribe to this service is the **OLE Uniform Data Transfer**. The CreateGroup method calls the method **DAdvise** of the **IDataObject** interface. Then notifications are sent to the **OnDataChange** method of the callback interface implemented with the **CAdviseSink** class in the tutorial.

The active property of the group can be changed with the **GetState** and **SetState** methods. The **SetActiveStatus** method uses this functionality to set or reset the property when the check box is changed.

9.2-6 Writing the Value of the Items to a Group

The tutorial uses the OPC synchronous write of the **IOPCSyncIO** interface to change the state of the PLC when one of the option buttons is checked. This is implemented in the **WritePLCStatus** method.

9.2-7 Closing the Tutorial

When it is closed, the tutorial program must in particular :

- Indicate to the OFS server that it no longer wishes to receive notifications on the user group : calling of the "***DUadvise***" primitive of the IDataObject interface.
- Remove the group using the "***RemoveGroup***" primitive.
- Release all server interfaces.

9.2-8 Managing OPC, OFS and Win32 Errors

In the tutorial, error handling is centralized in the **"HandleError"** function for all the OFS server primitives which are used.

The **"HandleError"** function performs a first pass to check the type of error and for formatting, then calls the **"GetErrorString"** OPC method of the IOPCServer interface.

9.3 OFS server compatibility

OFS is compatible with OPC 1.01A

OFS is compatible with any client application developped for **E**xchange **OLE S**erver: **eOLEs** V 1.0.600 IE13 supplied with the PCX PLC.

In particular, OFS supports the notion of **SYNCHRONOUS** group mono-request, mono-PLC. Syntactically, the name of a synchronous group begins by "$" (see section 6.3).

OFS supports also for compatibility the notion of **SYSTEM** group dedicated to only one couple of driver and PLC address:

System groups are related to a given device and are used to manage the specific items related to that device. System groups are distinguished from user groups by their name, which must contain the prefix "**_SYS=**".

A system group only contains the following specific items beginning by "#" :

- "#PLCStatus" for managing the operating mode of a PLC
- "#TimeOut" for managing the time-out of a communication medium
- "#NbrRequest" to know the number of requests sent to that device

OFS shares some common error names with eOLEs. Those code-names begin with the "EOL_" prefix standing for eOLEs.

Specific items and system groups can NOT be activated. No notification or asynchronous read/write is possible.

9.4 Glossary

Address	"Manufacturer" name of a control system variable. For example "**%**MW1".
Client application	Software using the primitives provided by a server application, via mechanisms (interfaces) set up by OLE.
Multi-client	Several client applications simultaneously accessing the same server application.
OPC group	Controls a collection of OPC items, ie. a list of PLC variables.
OPC item	PLC variable on a PLC and a given communication medium.
OPC server	Controls a collection of OPC groups. Hierarchical root of the OPC model.
Remote server	The client application and the server application are located on 2 separate stations connected via the Microsoft TCP/IP network.
Server application	Software displaying the primitives to the client applications, via mechanisms (interfaces) set up by OLE.
Socket	Communication channel established between the OFS server and one or more PLCs, on a given communication medium. The number of sockets available depends on the communication medium.
Symbol	Identifier assigned to a control system variable by a designer. For example "PUMP". A symbol cannot start with the prefix '%'.

9.5 Abbreviations

COM	**C**omponent **O**bject **M**odel : foundations of the OLE 2.0 standard.
DCOM	**D**istributed **COM** : COM model distributed on a network under TCP/IP.
OFS	**OPC F**actory **S**erver : OLE server for exchanging data with the PLC.
FIP	**F**actory **I**nstrumentation **P**rotocol.
LCID	**L**anguage **C**ode **ID**entifier.
OLE	**O**bject **L**inking and **E**mbedding. In particular provides the OLE Automation interface, a technique which enables a server to expose primitives and properties to a Client.
OPC	**O**LE for **P**rocess **C**ontrol.
PLC	**P**rogrammable **L**ogical **C**ontroller
SP	**S**ervice **P**ack : corrections and upgrades to an operating system.
UNC	**U**niversal **N**aming **C**onvention.
VB	**V**isual **B**asic : widely used language supporting OLE Automation.
VBA	**V**isual **B**asic for **A**pplication : script language with Basic syntax included in the MS-Office suite.
Wintel	**Win**dows/**Intel** : describes a PC with a 32-bit Windows operating system and an Intel x86 processor.

9.6 Recommendations in the Event of a Problem

- **Using screen savers**

  It is not advisable to use a screen saver in parallel with the OFS server, and in particular screen savers with a password ("lock NT WorkStation" option).

- **User rights under NT 4.0**

  The OFS server will not run and can only be installed if the session is executed under an ADMINISTRATOR account.

- **Remote access problem with NT 4.0**

  Check that the user rights are correctly managed : adjust using the DCOMCNFG.exe tool.

- **ATL error message when the OFS server is instantiated by the client application**

  Text of the message :

  ```
  Debug Assertion Failed!Program:
  D:\dev\client\clientVB\clientVB.exe
  File: d:\DevStudio\VC\ATL\include\atlimpl.cpp
  Line: 1182
  Expression: hKeyParent != NULL
  ```

  You do not have the ADMINISTRATOR rights under NT 4.0.
  You must open a session on the account which has the administrator rights to run the OFS server.

- **"User-defined type not defined" error during compilation of the declaration of the "OPC Server" object in Visual Basic**

  Instruction to which the error applies :

  ```
  Dim SVR as IOPCServerDisp
  ```

  The interfaces presented by the OFS server are not recognised by Visual Basic. You must register these interfaces using the “Tools” > “References” menu of VB5 SP3 and then, select the OFSauto.dll for OFS.exe or OFSSimuAuto.dll for OFS_SIMU.exe since those OPC Automation in-proc handlers contain the Type Library of the server.

- **EOL_E_OPEN_SYMBOLS_FAILURE error obtained when creating a user group with symbols file**

  If you have not given the absolute path for the file, check that the "Symbols" option is correct in the registry.

  If you have not defined this option, check that the C:\OPC_SYMB directory exists and contains the .SCY or .FEF neutral file.

  If you have inserted a space after "=" in the name of the group, it must be removed.

  Example :

  "grpName= symb.scy" becomes "grpName=symb.scy".

9.7 Exhaustive List of Error Codes

9.7-1 Main errors defined by OLE

HRESULT	NAME	COMMENT
00000000	**S**_OK	The primitive has been executed (**S**)uccessfully
00000001	**S**_FALSE	(**S**)uccess status for the primitive, but with at least one error on an item
80004005	E_FAIL	The primitive has failed
80010105	RPC_E_SERVERFAULT	The server has thrown an exception
8007000E	E_OUTOFMEMORY	Insufficient memory

9.7-2 Errors Defined by the OPC Standard

HRESULT	NAME	COMMENT
C0040001	OPC_E_INVALIDHANDLE	An invalid handle was passed
C0040002	OPC_E_DUPLICATE	A duplicate parameter was passed where one is not allowed
C0040003	OPC_E_UNKNOWNLCID	The server does not support the specified local id
C0040004	OPC_E_BADTYPE	The server cannot convert between the passed or requested data type and the canonical type
C0040005	OPC_E_PUBLIC	The requested operation cannot be done on a public group
C0040006	OPC_E_BADRIGHTS	The item's AccessRights do not allow the operation
C0040007	OPC_E_UNKNOWNITMEID	The item definition does not exist within the servers address space
C0040008	OPC_E_INVALIDITEMID	The item definition does not conform to the server's syntax
C0040009	OPC_E_INVALIDFILTER	The filter string is not valid
C004000A	OPC_E_UNKNOWNPATH	The item's access path is not known to the server
C004000B	OPC_E_RANGE	The value passed to WRITE was out of range
C004000C	OPC_E_DUPLICATE_NAME	A group with a duplicate name already exists in the server
0004000D	OPC_S_UNSUPPORTEDRATE	The server does not support the requested rate, but will use the closest available
0004000E	OPC_S_CLAMP	A value passed to WRITE was accepted, but was clamped

9.7-3 Errors Defined by the OFS Server

#	HRESULT	NAME	COMMENT
1	EFEF61A8	OFS_E_NO_DEFAULT_DIRECTORY	No default directory for symbol table
2	EFEF61A9	OFS_E_UNABLE_TO_RELOAD_ST	Unable to reload symbol table
3	EFEF61AA	OFS_E_UNSUPPORTED_ST_TYPE	Unsupported symbol table type
4	2FEF61AB	OFS_S_ST_NOT_CURRENTLY_USED	Symbol table not currently used
5	EFEF61AC	OFS_E_ALIAS_ALREADY_DEFINED	Alias already defined
6	EFEF61AD	OFS_E_ALIAS_OVERFLOW	Alias' number overflow
7	EFEF61AE	OFS_E_ALIAS_NOT_FOUND	Alias not found
8	EFEF61AF	OFS_E_UNABLE_TO_LOAD_ST	Unable to load symbol table
9	EFEF61B0	OFS_E_CF_FORMAT_NOT_SUPPORTED	Unsupported clipboard format
10	EFEF61B1	OFS_E_CANNOT_SET_SYSTEM_GROUP_STATE	Set state is not supported for system groups
11	EFEF61B2	OFS_E_DUPLICATE_CLIENT_HANDLE	Duplicate client handle
12	EFEF61B3	OFS_E_BAD_TYPE_REQUESTED	Bad type requested
13	EFEF61B4	OFS_E_READ_FAILURE	Read failure
14	EFEF61B5	OFS_E_SET_ITEM_STATE_SYNCHRO	Changes of item state in synchro group forbidden
15	EFEF61B6	OFS_E_SAFEARRAY_CREATION_FAILURE	The creation of a SAFEARRAY has failed
16	EFEF61B7	OFS_E_SAFEARRAY_EMPTY	An empty SAFEARRAY was found
17	EFEF61B8	OFS_E_ASYNC_READ_REJECTED	Rejected Asynchronous READ
18	EFEF61B9	OFS_E_THREAD_CREATION_FAILURE	The creation of a thread failed
19	EFEF61BA	OFS_E_NO_ACTIVE_ITEM	There is no active item
20	EFEF61BB	OFS_E_GROUP_NOT_ACTIVE	The group is not active
21	EFEF61BC	OFS_E_TRANSACTION_NOT_FOUND	The transaction ID was not found

#	HRESULT	NAME	COMMENT
22	EFEF61BD	OFS_E_BAD_GROUP_TYPE_FOR_ITEM	Cannot create the specified item in the group
23	EFEF61BE	OFS_E_ST_NOT_DEFINED	Symbol table not defined
24	EFEF61BF	OFS_E_ASYNC_WRITE_REJECTED Asynchronous WRITE	Rejected
25	EFEF61C0	OFS_E_MODBUS_MBT_RCV_TO	Time-out on Modbus TCP/IP network
26	EFEF61C1	OFS_E_MODBUS_MBT_RCV_ERROR	Receive Error on Modbus TCP/IP network
27	EFEF61C2	OFS_E_MODBUS_MBT_SEND_ERROR	Send Error on Modbus TCP/IP network
28	EFEF61C3	OFS_E_MODBUS_NCB_WAIT_ERROR	Receive Error on Modbus+ network
29	EFEF61C4	OFS_E_MODBUS_NCB_SEND_ERROR Modbus+ network	Send Error on
30	EFEF61C5	OFS_E_MODBUS_NCB_BAD_ANSWER	Bad Answer Received on Modbus (object out of configuration ??)
31	EFEF61C6	OFS_E_CONCEPT_IEC_NOT_SUPPORTED	IEC Runtime Concept not supported by this device
32	EFEF61C7	OFS_E_MODBUS_DEVICE_NOT_CONSISTENT	Consistency error between Modbus Device and Symbol table
33	EFEF61C8	OFS_E_MODBUS_DETECTION_DEVICE_ERROR	Modbus Device not found
34	EFEF61C9	OFS_E_MODBUS_TO_CHECK_CNX	Time-out error when searching Modbus device
35	EFEF61CA	OFS_E_MODBUS_DRIVER_ID_ERROR	Driver identification error
36	EFEF61CB	OFS_E_NETLIB_OPEN_ERROR	Netlib library open error
37	EFEF61CC	OFS_E_NETLIB_LOAD_ERROR	Netlib DLL load error
38	EFEF61CD	OFS_E_MODBUS_PLUS_DRIVER_NOT_FOUND	Modbus+ driver not found (not installed ??)

#	HRESULT	NAME	COMMENT
39	EFEF61CE	OFS_E_NCB_OPEN_ERROR	MODBUS + : DM or PM path open error (all paths used ?)
40	EFEF61CF	OFS_E_NCB_REOPEN_ERROR	MODBUS + : DM or PM path re-open error (all paths used ?)
41	EFEF61D0	OFS_E_MODBUS_MBT_CONNECT1	Server Internal Error
42	EFEF61D1	OFS_E_MODBUS_MBT_BAD_SOCKET	Server Internal Error
43	EFEF61D2	OFS_E_MODBUS_MBT_SETSOCKOPT1	Server Internal Error
44	EFEF61D3	OFS_E_MODBUS_MBT_SETSOCKOPT2	Server Internal Error
45	EFEF61D4	OFS_E_MODBUS_MBT_SETSOCKOPT3	Server Internal Error
46	EFEF61D5	OFS_E_MODBUS_MBT_DNS_FAILED	DNS / IP address impossible (Name not found ?)
47	EFEF61D6	OFS_E_MODBUS_MBT_BAD_HOST	Server Internal Error
48	EFEF61D7	OFS_E_MODBUS_MBT_BAD_INET	Incorrect IP address
49	EFEF61D8	OFS_E_MODBUS_MBT_BAD_SOCKSTATE1	Server Internal Error
50	EFEF61D9	OFS_E_MODBUS_MBT_BAD_SEND	Server Internal Error
51	EFEF61DA	OFS_E_MODBUS_MBT_BAD_STATE	Server Internal Error
52	EFEF61DB	OFS_E_MODBUS_MBT_OVERFLOW	Modbus request Waiting emission Queue full
53	EFEF61DC	OFS_E_MODBUS_IOCTL1	Server Internal Error
54	EFEF61DD	OFS_E_MODBUS_IOCTL2	Server Internal Error
55	EFEF61DE	OFS_E_MODBUS_IOCTL3	Server Internal Error
56	EFEF61DF	OFS_E_MODBUS_IOCTL4	Server Internal Error
57	EFEF61E0	OFS_E_MODBUS_IOCTL5	Server Internal Error
58	EFEF61E1	OFS_E_MODBUS_IOCTL6	Server Internal Error
59	EFEF61E2	OFS_E_MODBUS_IOCTL7	Server Internal Error
60	EFEF61E3	OFS_E_XWAY_IOCTL1	Server Internal Error
61	EFEF61E4	OFS_E_XWAY_IOCTL2	Server Internal Error
62	EFEF61E5	OFS_E_XWAY_IOCTL3	Server Internal Error
63	EFEF61E6	OFS_E_XWAY_IOCTL4	Server Internal Error
64	EFEF61E7	OFS_E_XWAY_IOCTL5	Server Internal Error
65	EFEF61E8	OFS_E_XWAY_IOCTL6	Server Internal Error
66	EFEF61E9	OFS_E_XWAY_IOCTL7	Server Internal Error

#	HRESULT	NAME	COMMENT
67	EFEF61EA	OFS_E_XWAY_IOCTL8	Server Internal Error
68	EFEF61EB	OFS_E_XWAY_IOCTL9	Server Internal Error
69	EFEF61EC	OFS_E_XWAY_IOCTL10	Server Internal Error
70	EFEF61ED	OFS_E_XWAY_IOCTL11	Server Internal Error
71	EFEF61EE	OFS_E_XWAY_IOCTL12	Server Internal Error
72	EFEF61EF	OFS_E_XWAY_IOCTL13	Server Internal Error
73	EFEF61F0	OFS_E_XWAY_IOCTL14	Server Internal Error
74	EFEF61F1	OFS_E_XWAY_IOCTL15	Server Internal Error
75	EFEF61F2	OFS_E_MODBUS_LIST1	Server Internal Error
76	EFEF61F3	OFS_E_MODBUS_LIST2	Server Internal Error
77	EFEF61F4	OFS_E_MODBUS_LIST3	Server Internal Error
78	EFEF61F5	OFS_E_MODBUS_LIST4	Server Internal Error
79	EFEF61F6	OFS_E_MODBUS_LIST5	Server Internal Error
80	EFEF61F7	OFS_E_MODBUS_LIST6	Server Internal Error
81	EFEF61F8	OFS_E_MODBUS_LIST7	Server Internal Error
82	EFEF61F9	OFS_E_MODBUS_LIST8	Server Internal Error
83	EFEF61FA	OFS_E_MODBUS_LIST9	Server Internal Error
84	EFEF61FB	OFS_E_MODBUS_LIST10	Server Internal Error
85	EFEF61FC	OFS_E_XWAY_LIST1	Server Internal Error
86	EFEF61FD	OFS_E_XWAY_LIST2	Server Internal Error
87	EFEF61FE	OFS_E_XWAY_LIST3	Server Internal Error
88	EFEF61FF	OFS_E_XWAY_LIST4	Server Internal Error
89	EFEF6200	OFS_E_XWAY_LIST5	Server Internal Error
90	EFEF6201	OFS_E_XWAY_LIST6	Server Internal Error
91	EFEF6202	OFS_E_XWAY_LIST7	Server Internal Error
92	EFEF6203	OFS_E_XWAY_LIST8	Server Internal Error
93	EFEF6204	OFS_E_XWAY_LIST9	Server Internal Error
94	EFEF6205	OFS_E_MODBUS_BAD_READCPU	Server Internal Error
95	EFEF6206	OFS_E_MODBUS_CMD_FAILURE	Server Internal Error
96	EFEF6207	OFS_E_MODBUS_LOGIN_FAILURE	This device is already reserved by other tool (Concept ?)
97	EFEF6208	OFS_E_MODBUS_LOGOUT_FAILURE	Server Internal Error
98	EFEF6209	OFS_E_XWAY_NET_OPEN	Server Internal Error

#	HRESULT	NAME	COMMENT
99	EFEF620A	OFS_E_XWAY_NET_ATTACH	Server Internal Error
100	EFEF620B	OFS_E_XWAY_NET_LOCALINFO	Server Internal Error
101	EFEF620C	OFS_E_XWAY_TEST_PDU_SIZE	Server Internal Error
102	EFEF620D	OFS_E_XWAY_DRIVER_ID_ERROR	Server Internal Error
103	EFEF620E	OFS_E_XWAY_CHECK_DEVICE	Server Internal Error
104	EFEF620F	OFS_E_XWAY_BAD_READCPU	Server Internal Error
105	EFEF6210	OFS_E_XWAY_READCPU_FAILURE	Server Internal Error
106	EFEF6211	OFS_E_XWAY_WRITECPU_FAILURE	Server Internal Error
107	EFEF6212	OFS_E_XWAY_BAD_CMD	Server Internal Error
108	EFEF6213	OFS_E_BAD_PATH_SPECIFIC_ITEM	Server Internal Error
109	EFEF6214	OFS_E_DIAG_CNX_OPEN	Server Internal Error
110	EFEF6215	OFS_E_NO_DIAG_CNX	Server Internal Error
111	EFEF6216	OFS_E_SPECIFIC1	Server Internal Error
112	EFEF6217	OFS_E_SPECIFIC2	Server Internal Error
113	EFEF6218	OFS_E_DRVMDB1	Server Internal Error
114	EFEF6219	OFS_E_REQMDB1	Server Internal Error
115	EFEF621A	OFS_E_REQMDB2	Server Internal Error
116	EFEF621B	OFS_E_MISCXWAY1	Server Internal Error
117	EFEF621C	OFS_E_TMDB1	Server Internal Error
118	EFEF621D	OFS_E_TMDB2	Server Internal Error
119	EFEF621E	OFS_E_TMDB3	Server Internal Error
120	EFEF621F	OFS_E_TMDB4	Server Internal Error
121	EFEF6220	OFS_E_TMDB5	Server Internal Error
122	EFEF6221	OFS_E_TMDB6	Server Internal Error
123	EFEF6222	OFS_E_TMDB7	Server Internal Error
124	EFEF6223	OFS_E_TMDB8	Server Internal Error
125	EFEF6224	OFS_E_TMDB9	Server Internal Error
126	EFEF6225	OFS_E_TMDB10	Server Internal Error
127	EFEF6226	OFS_E_TMDB11	Server Internal Error
128	EFEF6227	OFS_E_MISCXWAY2	Server Internal Error
129	EFEF6228	OFS_E_NETLOCAL1	Server Internal Error
130	EFEF6229	OFS_E_T_VM1	Server Internal Error
131	EFEF622A	OFS_E_T_VM2	Server Internal Error

#	HRESULT	NAME	COMMENT
132	EFEF622B	OFS_E_T_VM3	Server Internal Error
133	EFEF622C	OFS_E_T_VM4	Server Internal Error
134	EFEF622D	OFS_E_T_VM5	Server Internal Error
135	EFEF622E	OFS_E_T_VM6	Server Internal Error
136	EFEF622F	OFS_E_T_VM7	Server Internal Error
137	EFEF6230	OFS_E_T_VM8	Server Internal Error
138	EFEF6231	OFS_E_T_VM9	Server Internal Error
139	EFEF6232	OFS_E_T_VM10	Server Internal Error
140	EFEF6233	OFS_E_T_VM11	Server Internal Error
141	EFEF6234	OFS_E_READ_SYNC_FAILURE	Server Internal Error
142	EFEF6235	OFS_E_SRVM1	Server Internal Error
143	EFEF6236	OFS_E_SRVM2	Server Internal Error
144	EFEF6237	OFS_E_SRVM3	Server Internal Error
145	EFEF6238	OFS_E_RW1	Server Internal Error
146	EFEF6239	OFS_E_BAD_SYS_GROUP	Bad System Group definition
147	EFEF623A	OFS_E_BAD_ITEM_NUMBER	Server Internal Error
148	EFEF623B	OFS_E_BAD_POSTFIX	Bad postfix for this item
149	EFEF623C	OFS_E_DUPL_POSTFIX	Postfix Redefinition Error for this item
150	EFEF623D	OFS_E_DUPL_ARRAY_LEN	Array Len Redefinition Error for this item
151	EFEF623E	OFS_E_BAD_RANGE_ID	Bad range_id for Modbus Address
152	EFEF623F	OFS_E_WRONG_DIGIT_NUMBER	Wrong digit number for Modbus address (6 digits in any case)
153	EFEF6240	OFS_E_WRONG_ARRAY_LEN	Array Length Definition Error
154	EFEF6241	OFS_E_NO_ARRAY_OF_ARRAY	Array of Array not supported (Redefinition Error ?)
155	EFEF6242	OFS_E_MODBUS_UNSUPPORTED_DATA_TYPE	MODBUS unsupported data type
156	EFEF6243	OFS_E_NO_MODBUS_REQ_GEN_ERROR	Server Internal Error
157	EFEF6244	OFS_E_NO_MODBUS_REQ_GENERATED	Server Internal Error

#	HRESULT	NAME	COMMENT
158	EFEF6245	OFS_E_BAD_MODBUS_ITEM_DEF	MODBUS Item definition Error
159	EFEF6246	OFS_E_WRITESYNC_FAILURE	Write Failure
160	EFEF6247	OFS_E_BAD_IEC_WRITE_ANSWER	Write request reject by the Quantum IEC Runtime
161	EFEF6248	OFS_E_NO_REQ_TO_SEND	Server Internal Error
162	EFEF6249	OFS_E_MODBUS_SEND_FAILURE	Server Internal Error
163	EFEF624A	OFS_E_REMOVE_ERR1	Server Internal Error
164	EFEF624B	OFS_E_REMOVE_ERR2	Server Internal Error
165	EFEF624C	OFS_E_DEACTIVE_ERR	Server Internal Error
166	EFEF624D	OFS_E_MOD_RATE_ERR	Server Internal Error
167	EFEF624E	OFS_E_MODBUS_THREAD_FAILURE	Server Internal Error
168	EFEF624F	OFS_E_MODBUS_READ_FAILURE	Modbus Read Failure
169	EFEF6250	OFS_E_XWAY_BAD_ITEM_DEF	XWAY Item definition Error
170	EFEF6251	OFS_E_XWAY_UNSUPPORTED_DATA_TYPE	XWAY unsupported data type
171	EFEF6252	OFS_E_NO_XWAY_REQ_GEN_ERROR	Server Internal Error
172	EFEF6253	OFS_E_NO_XWAY_REQ_GENERATED	Server Internal Error
173	EFEF6254	OFS_E_XWAY_READ_FAILURE	XWAY read failure
174	EFEF6255	OFS_E_XWAY_BAD_WRITE_ANSWER1	Server Internal Error
175	EFEF6256	OFS_E_XWAY_BAD_WRITE_ANSWER2	Server Internal Error
176	EFEF6257	OFS_E_XWAY_EXEC_READ_FAILURE	Server Internal Error
177	EFEE4971	EOL_E_INVALID_GROUP_NAME	Invalid group name
178	6FEE4972	EOL_**S**_INVALID_APPLI_NAME	Name of application in PLC differs from name registered in symbols file
179	6FEE4973	EOL_**S**_INVALID_APPLI_VERSION	Evolution number of application in PLC differs from number registered in symbols file
180	EFEE4974	EOL_E_INVALID_ARG1	Argument 1 is not valid
181	EFEE4975	EOL_E_INVALID_ARG2	Argument 2 is not valid
182	EFEE4976	EOL_E_INVALID_ARG3	Argument 3 is not valid

#	HRESULT	NAME	COMMENT
183	EFEE4977	EOL_E_INVALID_ARG4	Argument 4 is not valid
184	EFEE4978	EOL_E_INVALID_ARG5	Argument 5 is not valid
185	EFEE4979	EOL_E_INVALID_ARG6	Argument 6 is not valid
186	EFEE497A	EOL_E_INVALID_ARG7	Argument 7 is not valid
187	EFEE497B	EOL_E_INVALID_ARG8	Argument 8 is not valid
188	EFEE497C	EOL_E_INVALID_ARG9	Argument 9 is not valid
189	EFEE497D	EOL_E_INVALID_ARG10	Argument 10 is not valid
190	EFEE497E	EOL_E_INVALID_ARG11	Argument 11 is not valid
191	EFEE497F	EOL_E_INVALID_ARG12	Argument 12 is not valid
192	EFEE4980	EOL_E_INVALID_TYPE	The type of the variable is invalid
193	EFEE4981	EOL_E_MISSING_NEUTRAL_FILE	The neutral file of definition of symbols is missing
194	EFEE4982	EOL_E_MISSING_OPCerror_DLL	The resource file OPCerror.dll can't be loaded
195	EFEE4983	EOL_E_MISSING_EOLESerr_DLL	The resource file EOLESerr.dll can't be loaded
196	EFEE4984	EOL_E_RESOURCE_NOT_FOUND	The resource DLL isn't found
197	EFEE4985	EOL_E_MSG_NOT_FOUND	The message isn't found
198	EFEE4986	EOL_E_EXPECTED_ARRAY_VALUES	An ARRAY of values is expected
199	EFEE4987	EOL_E_EXPECTED_SINGLE_VALUE	A SINGLE value is expected and not an array
200	EFEE4988	EOL_E_EXPECTED_DIM1	An array of values is expected with only ONE dimension
201	EFEE4989	EOL_E_UNEXPECTED_BOUNDS	The limits of the table are invalid
202	EFEE498A	EOL_E_INVALID_ITEMS_NBR	The number of items are incorrect

#	HRESULT	NAME	COMMENT
203	EFEE498B	EOL_E_INVALID_PATH	The item's driver or PLC address differs with regard to previous items
204	EFEE498C	EOL_E_ERR16bit_OUTofRANGE	The 16-bit error code is out of range
205	EFEE498D	EOL_E_ONLY_ONE_REQUEST	Too much items : this group must be translated on ONLY ONE PLC request
206	EFEE498E	EOL_E_FEATURE_DISABLED	This feature has been disabled by the administrator
207	EFEE498F	EOL_E_GROUP_DELETED	This group has been LOGICALLY deleted
208	EFEE4990	EOL_E_INVALID_COMMAND	Use 1 for UpLoad from the PLC or 2 for DownLoad to the PLC
209	EFE913EE	EOL_E_ILLEGAL_CHARACTER	Syntax error: illegal character
210	EFE913EF	EOL_E_INDEX_NUMBER_ERROR	Syntax error: index number error
211	EFE913F0	EOL_E_INVALID_SYNTAX	Syntax error: incorrect syntax
212	EFE913F1	EOL_E_LEXEM_TOO_LARGE	Syntax error: name of object is too long
213	EFE913F2	EOL_E_INVALID_OBJECT	Syntax error: incorrect object
214	EFE913F3	EOL_E_KEYWORD_ERROR	Syntax error: keyword
215	EFE913F4	EOL_E_SYNTAX_ERROR_2	Syntax error
216	EFE913F5	EOL_E_INVALID_END_OF_PHRASE	Syntax error: incorrect end of phrase
217	EFE913F6	EOL_E_SYNTAX_ERROR	Syntax error
218	EFE913F7	EOL_E_INCORRECT_SYMBOL	Syntax error: incorrect symbol
219	EFE913F8	EOL_E_INCORRECT_INDEX_SYMBOL	Syntax error: incorrect index symbol
220	EFE913F9	EOL_E_INCORRECT_BIT_INDEX_SYMBOL	Syntax error: the index symbol of the extracted bit is incorrect

#	HRESULT	NAME	COMMENT
221	EFE913FA	EOL_E_UNDEFINED_INDEX_SYMBOL	Syntax error: the index symbol is not defined
222	EFE913FB	EOL_E_INVALID_SYMBOL	Syntax error: the symbol is not defined
223	EFE913FC	EOL_E_OBJECT_NOT_SYNTHESIZED	Synthesis error: the object cannot be synthesized
224	EFE913FD	EOL_E_INVALID_ARRAY_SIZE	Syntax error: incorrect table length
225	EFE913FE	EOL_E_INCORRECT_PATH_SIZE	Syntax error: incorrect path size.
226	EFE913FF	EOL_E_OBJECT_FORMAT_TOO_LARGE	Syntax error: object format too large
227	EFE91400	EOL_E_INCORRECT_OBJECT_FORMAT	Syntax error: incorrect object format
228	EFE91401	EOL_E_UNSIGNED_OBJECT_ERROR	Syntax error: object has no sign
229	EFE91402	EOL_E_EMPTY_EXPRESSION	Syntax error: blank expression
230	EFE91403	EOL_E_ILLEGAL_INDEXES	Syntax error: indexes are illegal
231	EFE91404	EOL_E_ILLEGAL_ARRAYS	Syntax error: Tables are illegal.
232	EFE91405	EOL_E_NO_SEPARATOR	Syntax error: no separator in front of the object
233	EFED4845	EOL_E_CODE4INIT_ERROR	CodeBase failure during CODE4INIT function
234	EFED4846	EOL_E_D4APPENDSTART_ERROR	CodeBase failure during D4APPENDSTART function
235	EFED4847	EOL_E_D4CREATE_ERROR	CodeBase failure during D4CREATE function
236	EFED4848	EOL_E_I4CREATE_ERROR	CodeBase failure during I4CREATE function
237	EFED4849	EOL_E_D4FIELD_ERROR	CodeBase failure during D4FIELD function

#	HRESULT	NAME	COMMENT
238	EFED484A	EOL_E_D4TAG_ERROR	CodeBase failure during D4TAG function
239	EFED484C	EOL_E_D4APPEND_ERROR	CodeBase failure during D4APPEND function
240	EFED484D	EOL_E_RELATE4INIT_ERROR	CodeBase failure during RELATE4INIT function
241	EFED484E	EOL_E_RELATE4QUERYSET_ERROR RELATE4QUERY_SET function	CodeBase failure during
242	EFED484F	EOL_E_RELATE4TOP_ERROR	CodeBase failure during RELATE4_TOP function
243	EFED4850	EOL_E_RELATE4SKIP_ERROR	CodeBase failure during RELATE4_SKIP function
244	EFED4851	EOL_E_INVALID_SYMBOLS_FILE	Content of symbols file is not valid
245	EFED4852	EOL_E_OPEN_SYMBOLS_FAILURE	Failure during opening of symbols file : invalid name or path, file not found, ...
246	EFED4853	EOL_E_ERRORS_IN_SYMBOLS_FILE	Errors in symbols file : syntax error in a line, double definition of same address or symbol
247	EFED4854	EOL_E_NO_OBJECT_FOR_SYMBOL	No object found
248	EFED4855	EOL_E_INPUT_BUFFER_TOO_LARGE	Input buffer is too large
249	EFED4856	EOL_E_OUTPUT_BUFFER_TOO_SMALL	Output buffer is too small
250	EFE84DBD	EOL_E_REQUESTS_OPTIMIZATION_ERROR1	Internal error in requests optimization : object addressing mode is not on 2 bytes
251	EFE84DBE	EOL_E_REQUESTS_OPTIMIZATION_ERROR2	Internal error in requests optimization : object addressing mode is not on 5 bytes

#	HRESULT	NAME	COMMENT
252	EFE84DBF	EOL_E_REQUESTS_OPTIMIZATION_ERROR3	Internal error in requests optimization : invalid object addressing mode
253	EFE84DC0	EOL_E_REQUESTS_OPTIMIZATION_ERROR4	Internal error in requests optimization : invalid ROL object
254	EFE84DC1	EOL_E_REQUESTS_OPTIMIZATION_ERROR5	Internal error in requests optimization : invalid Element object
255	EFE84DC2	EOL_E_REQUESTS_OPTIMIZATION_ERROR6	Internal error in requests optimization : invalid Info object
256	EFE84DC3	EOL_E_REQUESTS_OPTIMIZATION_ERROR7	Internal error in requests optimization : ROL object number greater than number of existing objects
257	EFE84DC4	EOL_E_REQUESTS_OPTIMIZATION_ERROR8	Internal error in requests optimization : Element object number greater than number of existing objects
258	EFE84DC5	EOL_E_REQUESTS_OPTIMIZATION_ERROR9	Internal error in requests optimization : Info object number greater than number of existing objects
259	EFE84DC6	EOL_E_REQUESTS_OPTIMIZATION_ERROR10	Internal error in requests optimization : unprocessed option
260	EFE84DC7	EOL_E_REQUESTS_OPTIMIZATION_ERROR11	Internal error in requests optimization : options implemented in a future version
261	EFE84DC8	EOL_E_REQUESTS_OPTIMIZATION_ERROR12	Internal error in requests optimization : object not supplied in this version
262	EFE84DC9	EOL_E_REQUESTS_OPTIMIZATION_ERROR13	Internal error in requests optimization : invalid access type

#	HRESULT	NAME	COMMENT
263	EFE84DCA	EOL_E_REQUESTS_OPTIMIZATION_ERROR14	Internal error in requests optimization : invalid parameters
264	EFE84DCB	EOL_E_REQUESTS_OPTIMIZATION_ERROR15	Internal error in requests optimization : request data size greater than buffer size
265	EFE84DCC	EOL_E_OUT_OF_BITSARRAY_BOUNDARY	The array of bits has a size exceeding the allowed boundary
266	EFE84DCD	EOL_E_BAD_IO_TYPE	Internal error in requests optimization : Bad IO Type
267	EFE84DCE	EOL_E_BAD_ADDR_LENGTH	Internal error in requests optimization : IO Adress length is not supplied
268	EFE84DCF	EOL_E_READ_ARRAY_FORBIDDEN	Reading this kind of array is not allowed
269	EFE84DD0	EOL_E_MBI_NOT_ARRAY	This kind of object must be call with a array form